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MALIGNANT DISEASE: ITS PROBLEMS FROM THE STANDPOINT OF THE CONSULTING RADIOLOGIST.

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It is refreshing, from time to time, to pause amid the fruits of our collective labours and gaze upon the widened prospect which lies before us striving to make out the dim form of truths which are emerging half veiled in the mists of the early dawn of knowledge, upon the horizon of our inquiries.

(T. Brailsford Robertson, Ph.D., D.Sc.).

THE communication by Röntgen to the Physico-medical Society of Würzberg in November, 1895, "concerning a new kind of ray" stirred the scientific imagination of the time. Immediate investigations were made in all countries into the nature and properties of the new rays (X rays). Today our basic ideas of the structure of matter have been fundamentally changed with the unpredicted result that the mechanism of chemical, physical and biological reactions has been given new interpretations.

In the period of early experimentation it was observed that prolonged exposures to the rays produced redness of the skin followed at times by inflammation and even ulceration. This suggested the use of X rays in the treatment of disease. Success was claimed for their use against malignant disease. The importance of accurate dosage was not realized, so that repeated failures, many with distressing sequelæ, brought the method into disrepute in many quarters. This phase of depression passed when it was shown that the blame for unsatisfactory results was largely due to errors of technique and inadequate knowledge of the limitations of the rays in therapy.

In 1918 the Erlangen school of radiologists offered us a new radiotherapeutic technique, so-called deep therapy. It was claimed that by its use certain control of malignant processes could be obtained. In essence it was a modification directed to the application of the radiation to deep-seated cancer, so that the skin and healthy tissues of the patient received such a dose of radiation that full recovery was possible, while the cancer received a lethal dose. They said that a cure depended solely on delivering an adequate quantity of radiation to the tumour, the quantity could be predetermined from a knowledge of the histology of the tumour. These assertions were being made when my interest in the use and results of radiotherapy for malignant disease was aroused.

It must be readily admitted now that the many extravagant claims made for deep therapy during the period of its introduction as a cure for cancer cannot be upheld. Statistical reviews of the end results in patients treated by these methods reveal many disappointments and are liable to create wrong impressions as to the value of persevering with their use in our attack on this formidable disease.

Although one cannot claim that many more lives have been saved since the introduction of deep therapy, an examination of the cancer problem from the point of view of the clinical radiotherapeutist will indicate the possibilities of his methods. The value of surgery in early malignant disease is not questioned, but in advanced and recurrent lesions it has definite limits which are often exceeded in courageous attempts to relieve hopeless conditions. Deep therapy is convenient, painless and practically without shock. It has a potent influence on cell, tissue and body metabolism and under as yet unknown conditions causes tumour regression. A thorough examination of this non-surgical agent is fully justified in spite of the failures of the past.

My endeavour will be to correlate the clinical impressions of cancer diagnosis and treatment with the experimental results and speculative theories of others. The radiologist as clinician is acutely conscious of his position on the shifting sands of empiricism when using deep therapy. I shall follow the physicist and cytologist in their researches into the nature of radiation and the structure of living matter and their interactions so that alterations in normal and neoplastic protoplasm exposed to radiation may be discussed. If gaps in fact are connected by flights of fancy, it will be with a desire to give coherence to these obscure reactions.

My plea is for a more systematic study of cancer from its clinical aspects, so that the bold outlines of its problems will not be hidden as each wave of enthusiasm for the particular fashionable therapeutic mode of the moment rolls over us.

An exhaustive review of the behaviour of each type of neoplasm will not be attempted. Broad considerations of the problems involved based on the clinical aspects of the unselected material met with in consulting diagnostic and therapeutic radiology will be my main interest.

THE ŒSOPHAGUS.

The patients with malignant disease of the œsophagus were all past middle age. Both sexes were represented with males predominating. The diagnosis was made from the history and radioscopic and œsophagoscopic findings and confirmed by the invariably unfavourable course of the disease. The majority of the lesions were situated in the distal third of the gullet. In the upper third œsophago-tracheal fistula was a common and distressing complication, making the respiratory tract symptoms unduly prominent in the clinical picture.

Gastrostomy was not advised as a routine. When it was performed, harassing dysphagia was avoided and the general nutrition improved. It should be carried out as soon as the diagnosis is established.

Five needles with a filtration equivalent to 0·5 millimetre of platinum and containing ten milligrammes of radium element each placed in a brass capsule with walls two millimetres thick were used as an adjuvant in several instances. It was not

possible to introduce the radium in this form into the lumen of the stricture. Under radioscopic control the capsule was passed into the gullet and its lower end rested on the upper limit of the growth. It was left in position for twenty-four hours. Under these conditions practically all of the effective radiation is directed into normal tissues above the growth. This method of using radium for cancer of the gullet has nothing to recommend it.

These patients so treated presented no difference in their subsequent histories from those in whom deep therapy alone was used. The deep therapy applications were made through four or six ports of entry cross-firing at the level of the lesion. The completed dose to the tumour was from 130% to 150% of an erythema skin dose. About three-quarters of the patients were temporarily relieved of pain and one-half showed some slight passing improvement in swallowing. After a little time the downward course of the disease was reestablished and maintained in spite of further treatment by radiation.

The Stomach.

The patients with malignant disease of the stomach were of both sexes in the common age period of cancer incidence. The diagnosis was made on the history and test meal and radiological examinations. It was noted that progressive loss of weight and distaste for food were common features even before pain and vomiting. In a few instances a history of long-standing painful dyspepsia suggested the probability that the malign process arose in chronic ulceration. In the majority the period of onset was of short duration. All the lesions treated were inoperable. This was determined by laparotomy.

In no instance was the course of the disease altered. When cachexia was pronounced it is likely that the treatment hastened death.

It is of interest to note the changes that followed a skin dose of deep therapy given to a stomach affected by malignant disease when the organ was delivered from the abdomen by surgery of access (Mr. F. Macky) and directly exposed to the rays. The growth was of the bulky type attached to the posterior wall of the pyloric antrum. It was operable and no extragastric extension was discerned. No reaction to the irradiation was noticed. The wound healed by first intention and appeared to be normal. After twenty-four days the abdomen was reopened. In the depths of the wound it was found that loss of differentiation of the abdominal wall had occurred. It appeared pallid and unhealthy. This was taken as evidence of inadequate protection of the wound.

The growth as seen on the lesser curvature was puckered and of a yellowish colour. The lesser omentum was thinned and apparently avascular, the greater omentum was thickened and infiltrated without loss of its mobility. The striking finding was a number of small white, circumscribed tubercles scattered over the surface of the stomach which had been exposed to the radiation. The histological examination of the specimen removed by partial gastrectomy showed that the omental changes were reactionary and the gastric tubercles were composed mainly of giant cells of the type usually associated with foreign matter removal. The tumour showed no alterations that could be interpreted as reactions to the radiotherapy.

The abdominal wound healed without mishap and now four months after the experience the patient is well and gaining in weight.

The lesion was considered to be inoperable from clinical considerations. That this was not so was discovered only while the operation of access was being performed. The preoperative radiation was given largely as an experiment. In the same circumstances it is likely that resection would be done first and the radiation used as a post-operative prophylactic measure.

Glandular and visceral metastases from gastric carcinomata have not been influenced by radiotherapy.

The Colon and Rectum.

The diagnosis of cancer of the colon or rectum is usually made late in the course of the disease on account of the paucity of symptoms until obstruction is advanced. The clinician's suspicions are aroused by a history of persistent increasing bowel disability associated with abdominal uneasiness of a colicky type. The symptoms may be related to the taking of food or emptying of the bowels. A palpable tumour and anæmia are late manifestations.

The radiological examination is often indeterminate with early growths. Both opaque meal and opaque enema should be used in doubtful instances. Histologically the majority of the tumours are columnar-celled. They progress slowly and dissemination is a late feature. Metastases frequently involve the pelvic glands. The liver is the commonest site of visceral deposits.

Malignant bowel growths of all types are difficult to control with the present radiotherapeutic technique. This does not apply to the method of irradiating the tumour after its exposure by operation with radium. Such measures are outside my experience.

With the routine deep therapy applications all of the patients suffered in varying degrees from the local and general distress associated with abdominal treatments. Diarrhœa with mucus and blood was not uncommon, but recovery in quick time from this effect was the rule.

A course of intramuscular injections of colloidal copper was given as adjuvant treatment in an odd case without any effect on the fatal course of the disease.

One patient was alive and clinically free of disease fifteen months after treatment. She was a feeble lady, aged seventy years, with a large, polypoidal, hæmorrhagic, œdematous rectal mass diagnosed clinically as cancer of the rectum. Deep therapy arranged to deliver 120% erythema skin dose to the tumour was applied. This type of rectal carcinoma is less malignant than either the scirrhous or colloid varieties and more amenable to radiotherapy.

THE LIVER.

Radiotherapy was of no avail in primary or secondary malignant disease of the liver. Secondary deposits in the liver contraindicate radiotherapy to the primary lesion. This does not exclude its use for the relief of pain. Hepatic disease provides a fruitful field for research. Under certain conditions it provides opportunity for the study of inflammatory changes, simple adenomata and cancerous degeneration gradually merging with one another.

THE GALL BLADDER.

In the few instances observed the clinical suggestion was that the neoplastic process was superimposed on chronic inflammatory changes. There was no response of the growth to deep therapy.

THE BREAST.

The patients suffering from mammary cancer were females of ages ranging from twenty-five to sixty-five years. The left breast was more frequently involved. The time that elapsed from the first knowledge of the presence of a tumour to the seeking of advice varied from a few days to several months. In an isolated instance or two the medical attendant permitted a "wait and see" policy. Recurrences were noticed from one month to thirteen years after operation. As many as three surgical attempts had been made to eradicate the disease in several patients. The early appearance of the recurrences was related to the extent of the disease at the time of operation and the histological type of the tumour.

Although it is not possible to dogmatize about the pathological changes from the clinical findings, it is convenient in practice to separate the common primary inoperable lesions into four groups according to their clinical type.

Scirrhous Carcinoma (Spheroidal-Celled).

Scirrhous carcinoma was present in the majority of patients referred for deep therapy. The breast contained a relatively large, stony hard, circumscribed mass of indefinite outline placed eccentrically in the mamma and adherent to the chest wall and skin. The nipple was retracted. The axillary glands were invaded invariably. In several instances a typical malignant ulcer was present with elevated, indurated edges and sanious, disagreeable discharge. In a few patients the skin lymphatic vessels were involved producing *cancer en cuirasse*. In other instances wide-spread glandular, bony and visceral metastases were evident.

This group was not generally radiosensitive. It is difficult to be certain whether the usual slow progress of these lesions was restrained by the treatment.

Medullary Carcinoma (Adeno-Carcinoma).

In medullary carcinoma observed the lesions had developed slowly with skin destruction producing a fungating, hæmorrhagic outgrowth. Glandular deposits were present. This type of growth requires that radiation be applied carefully to avoid increasing the degree of necrosis.

Diffuse Duct Carcinoma (Columnar-Celled).

The patients with diffuse duct carcinoma had a scirrhous type of growth infiltrating the breast tissue without discrete tumour and usually accompanied by bloody nipple discharge.

Acute or Inflammatory Carcinoma (Spheroidal-Celled).

The enlarged, tense, tender breast with acute spheroidal-celled cancer had rapidly increased in size. The skin was brawny and involved by the disease. Glandular and visceral metastases were present. These cancers were an exception to the rule that rapidly growing, cellular tumours are radiosensitive. They did not exhibit even a transient clinical improvement. Such unsatisfactory results can be attributed, according to Ewing, to the failure of the fatty breast tissues to throw a barrier of defence against the invasion of the cancer and the inability of the radiation to excite a response in it.

The treated recurrences were mostly of the scirrhous type. The lesions commonly occurred in the operation scar or adjacent skin (40%) or in the supraclavicular glands (28%). The lungs, sternum, ribs, spine, pleura, pelvis and liver exhibited metastases in different patients. In two instances the other breast developed a clinically malignant tumour. These were regarded as metastases, although it was not possible to eliminate the probability of these being primary growths.

One patient had a recurrent sarcoma. She was a *nullipara*, aged forty-two years. The clinical characteristics of the tumour suggested a medullary carcinoma.

The varied histology of these growths has been studied minutely and described in detail. Cancer requires a previous pathological lesion in which to develop. From birth, through adolescence and lactation to the decline of the climacteric the cells of the breast undergo physiological changes of a highly complex nature. These alterations are important from the point of view of cancer ætiology. Overgrowth of epithelium, almost indistinguishable from that occurring physiologically and going on to the formation of papillomata with a few epithelial cells under the basement membrane, is a necessary preliminary change before cancer is clinically appreciable.

The histories of these patients reveal nothing to connect the mammary neoplasm with previous disease of the generative organs, with child-bearing or lactation or with heredity, trauma or acute or chronic inflammatory breast disease. Nearly one quarter of the patients were *nulliparæ*.

Notable clinical signs and symptoms included altered nipple axis and retraction, localized tumour as against nodular, indefinite mass, puckered skin, nipple discharge and stabbing pain, especially in early lesions.

Different observers hold divergent views on the advisability of using radiation in the treatment of inoperable mammary cancer. The varying results obtained when radical differences of technique are

employed, are largely responsible for these contrary opinions. In my experience although no cure was established there were a number of patients who had their cancers controlled for shorter or longer periods (six to twelve months). Pain was relieved and ease given to distressed minds.

The reaction usually exhibited by normal tissues does not necessarily follow when a similar dose is given to an area of which the blood and nerve supply has been altered by surgical interference. In such circumstances overdosage is likely to be unsatisfactory and even harmful, as further restriction of the blood supply to a part already undernourished courts disaster.

Deep therapy cannot compensate for any limitation of the surgical field. This applies to any form of radiotherapy. Radiation applied to recurrences is at best only palliative in the present state of technique and knowledge. On account of the generalized nature of the disease when these lesions develop, any form of treatment claimed as a cure will lead to many disappointments.

Postoperative irradiation has become a routine procedure following mastectomy. Some patients are treated with low voltage and three millimetres of aluminium filtration, others receive deep therapy. The majority of these women have operable scirrhous growths, so without any other treatment beyond radical removal need not expect a great diminution in their expectation of life.

The object in view in these instances is to inflict a direct lethal injury on any remaining cancer cells, to stimulate the local connective tissue formation and to occlude the lymphatic channels and so prevent dissemination of the growth. However, in the absence of knowledge concerning the parts played by the various cells and tissues in cancer defence and the uncertain effects of radiation on these elements, it is possible that the balance of the tissues may be upset and the potential cancer cells freed from inhibitory influences become the nucleus of a rapidly growing, intractable recurrence. Some such explanation is required to account for the uncontrollable increase of growth that at times follows radiotherapy.

When prophylaxis is the aim of treatment, the tendency is to administer small doses of low voltage radiation over a long period, while intensive therapy is reserved as an alternative to surgery in inoperable lesions.

Authorities differ about the wisdom and value of pre- and post-operative radiotherapy. My feeling is that with carefully selected technique post-operative radiation has a place in cancer treatment with a limited sphere of applicability.

When metastases appear, the prospect of obtaining a cure by any local treatment such as deep therapy as used at present, is hopeless. The odd case reported as a cure from these methods appears to represent a chance establishment of an efficient general immunity response. The effect cannot be predetermined or repeated with certainty.

The mechanism of the distribution of metastases in mammary cancer provides a useful example with which to illustrate the difficulties of the radiologist planning an adequate attack on metastatic malignant growths.

Dissemination takes place through the blood and lymph streams. The venous circulation may be entered by (i) tumour erosion, (ii) cancerous perivascular lymphatic vessels opening into a vein at a distance from the tumour, (iii) by a necrotic metastasis in a lymph gland involving a vein, (iv) cancer emboli in the lungs. The cancer cells may also spread in all directions as continuous chains in the lymphatic vessels of the deep fascia. The extension of the vessel walls excites a reaction which destroys the tumour cells and leaves a fibrous cord in place of the vessel. Failure of this reaction allows a metastasis to develop. This permeation is responsible for pleural, pulmonary, mediastinal, hepatic, osseous, dermatological and myological deposits. The regional glands are involved by lymphatic emboli. As an alternative to contamination of the wound it is suggested that cancer cells grow back from the deep fascia through collateral skin lymphatic vessels to the field of operation and, finding the scar with lowered resistance, make it a common site for recurrences. These considerations force the conclusion that if deep therapy or other radiation is employed in these patients for a direct lethal effect on the cancer cells, the present-day technique is haphazard. Any alteration directed towards giving general body exposures would not be without considerable danger and it could be undertaken only in the presence of definite indications which would have to be determined.

No cure was established by deep therapy. With beneficial treatment the tumour showed an increase of mobility and became softer and smaller. Affected glands became discrete. In a comparatively short time (months) these effects commenced to recede and the progress of the disease was reestablished. Further treatment as a rule failed to obtain even a temporary check to the course of the disease.

Pain was relieved for a variable time, ulceration lost its induration and discharge became serous and lessened in amount. Occasionally the cancer became operable. One of these patients developed a local recurrence within six weeks of operation and three months after the first exposure to radiation. The lesion did not respond to further radiotherapy.

Skin nodules usually disappeared after the first treatment. Recession of this type of secondary deposit was also obtained by using radium or low voltage technique. This draws attention to the importance of tissue receptivity as well as the type of radiation in successful radiotherapy. The desirable effect on the skin nodules was not always permanent. Subsequent reappearances did not show the same susceptibility to radiation, but tended to resist further exposures. *Cancer en cuirasse* was not altered by radiotherapy.

Bone metastases were unresponsive as a rule. At odd times a sternal deposit disappeared unexpectedly. Radiographic evidence suggesting bone regeneration after treatment was seen on occasions, but the *post mortem* findings discounted this interpretation by being compatible with active, progressive disease. In one patient severe pain appeared in the dorsal spine. Radiography did not reveal any evidence of bone changes. At necropsy no naked eye sign of metastases was discovered, but microscopically it was found that the Haversian canals of the bodies and processes of two or three of the dorsal vertebræ were filled with cancer cells.

Deposits in lymphatic glands were affected in varying degrees. The first treatment often freed them from one another and from their surroundings. Rarely were they apparently rid of disease. When growth recommenced, further radiotherapy was of little or no avail. The frequency with which the supraclavicular glands are involved raises the question of the necessity for including this group as a routine in the radical surgical procedure.

Pleural, pulmonary and hepatic metastases were taken as contraindications to radiotherapy.

In three patients pleuro-pulmonary fibrosis developed as a sequel to the treatment. This occurred early in the series with patients who had been treated with heavy filtration (one millimetre of copper). This technique gives a relatively high percentage depth dose. In each instance the course of treatment had been repeated once or twice. In later cases this undesirable effect was avoided by using less filtration (0·25 millimetre of copper) and directing the beams of radiation tangentially to the chest wall instead of perpendicularly to it.

Changes resembling scleroderma appeared in the skin of two or three patients who had had repeated exposures and survived long enough for this late effect to become manifest.

THE UTERUS.

Carcinoma of the Cervix Uteri.

All of the patients with carcinoma of the *cervix uteri* had borne children. Their ages ranged from thirty-five to sixty-five years. Clinically the lesions belonged to the three groups usually recognized. The cervix (i) was increased in size and extremely hard in consistence or (ii) presented a deep, foul ulceration or (iii) was the site of a more or less large fungating growth. Many of the patients were weakened by sepsis and hæmorrhage. Routine local and general treatment to combat these effects was adopted.

Histological data in inoperable disease are of more academic than clinical value and were not recorded in every instance. If operable growths are to be treated by radiotherapy, a sound prognosis can be given only if an intimate knowledge of the histology is available. The epidermoid and adenocarcinomatous growths may be alike to the naked eye. The former can be readily influenced by radiotherapy, while the latter are strikingly resistant.

It is difficult to correlate uniformly the effects of treatment with the clinical types. As a rule the ulcerated and fungating types were more radiosensitive than the other varieties.

The patients with primary inoperable disease admitted delay in seeking advice about their symptoms. This was partly due to the fact that they had had vaginal discharges for varying periods and had come to regard them as of no consequence. Chronic endocervicitis is an important precancerous lesion. Recurrences appeared in from six weeks to five years after operation.

Radium was usually used as an adjuvant in treatment. Intravaginal, intracervical, intrauterine and intratumoral applications were employed according to the indications in each instance. Five needles of 0·75 millimetre platinum filter each containing ten milligrammes of radium element enclosed in a brass capsule with walls one or two millimetres thick and placed in the cervical canal, were usually employed. The exposures were of twenty-four to thirty-six hours' duration. It was considered that 2,000 milligramme-hours gave 100% erythema skin dose to the tumour in contact with it, 25% at one centimetre distance, 10% at two centimetres distance and 2% at four centimetres. The deep therapy cross-fire was arranged to give the tumour and pelvic glands an even total distribution of 135% erythema skin dose.

When radium was used, the responsive tumours showed a quicker improvement than when deep therapy alone was applied. The relative ease with which radium can be used to get an even distribution of radiation through the growth, makes it the method of choice when radiotherapy is used for cervical carcinomata. Deep therapy has become the adjuvant, giving its greatest help when directed to pelvic extensions of the disease.

A discussion of the merits and uses of radium as against those of deep therapy in inoperable cancer and against those of surgery in operable lesions is outside the scope of the present considerations.

When massive doses of deep therapy were used, radiation sickness was a prominent and troublesome feature, but with fractional doses this bother practically disappeared with no appreciable alteration of the tumour effects.

In nearly all patients the radiation produced some benefit. In a few the cancer was clinically cured during the period of observation (three years). It was the rule for the primary growth and its pelvic extensions to be controlled at least temporarily. Symptoms were ameliorated. Vaginal disease responded better to radium than to deep therapy.

The treatment produced diarrhœa and vesical tenesmus in several patients. Recovery without permanent rectal or bladder disability took place quickly. In no instance was the treatment responsible for fistula formation. Repeated applications as in other organs did not procure the benefits of favourable first treatment. Repeated exposures

induced changes in the skin and subcutaneous tissues of the ports of entry. These tissues assumed a brawny hardness and were covered by atrophic skin marred by fine telangiectases.

Metastases outside the pelvis were very uncommon.

Deep therapy or radium is preferable to cauterization, curettage or ligation of the pelvic vessels for relieving the sufferings of these afflicted women.

Malignant Disease of the Uterine Body.

No patient with cancer of the uterine body was treated. This is explained, no doubt, by the fact that operative removal is highly successful in obtaining permanent cure.

Postoperative prophylactic treatment was given to a few patients.

A girl, aged five years, was treated for sarcoma of the uterus. Complete clinical regression of the new growth was procured. The patient died within twelve months from extensive radio-resistant pulmonary and spinal metastases.

The Ovary.

The age of the patients with cancer of the ovary ranged between twenty-eight and forty-five years. The usual pathological varieties were represented. There were several recurrences of cystic adenomata, some of them bilateral.

No patient had borne a full-time child. Each gave a history of long-standing menstrual irregularity. The recurrences appeared in from three months to three years. In two or three instances partial surgical removal only had been possible.

Although the radiotherapy of ovarian malignant disease is disappointing so far as cure is concerned, it produces clinical improvement in the patients and may prolong life. The results suggest that partial resection of the growth followed by full doses of radiation is a sequence of treatment worthy of trial. In asserting that deep therapy was a material benefit to these patients, I am aware that it is not an uncommon occurrence for incomplete surgical removal of ovarian tumours to initiate regression in the remnant. However, in the instances to which I refer, the growth of the neoplasm had been reestablished at the time deep therapy was used and clinical improvement followed its application in such a way that it is not unreasonable to give it credit for the benefits observed.

One patient had four courses of treatment. She developed several radiation sequelæ. The skin and subcutaneous tissues degenerated as in the case of the uterine patients, the pelvis was filled by mass fibrosis and repeated tapping was necessary to relieve the discomfort of a profuse ascites. Her general health declined. I regarded the condition as an example of X ray cachexia.

The Urethra.

A recurrent glandular epithelioma of the urethra in an elderly female was treated without benefit.

The Kidney.

A male child with recurrence of a renal sarcoma of the kidney was treated. A slight temporary regression of the tumour which had fungated through the operation wound, was noticed. Death followed infection and hæmorrhage.

A pulmonary metastasis which appeared after removal of a hypernephroma, was not affected by deep therapy applications.

The Prostate.

Scirrhous carcinoma of the prostate was the commonest diagnosis among the patients who were treated. Other lesions were classified as adenocarcinomata and fibro-sarcomata. In a few instances temporary alleviation of the distress accompanying urination was obtained. Clinically very little alteration was discernible in the size of the tumour. The sarcomata were exceptions in this regard. The stony hardness tended to soften and the tumours tended to become nodular for a while, but after the palliation of symptoms had passed, the induration returned and the disease ran its fatal course.

It is interesting to recall that widespread bony metastases accompanied by a megaloblastic anæmia with low colour index may be the first intimation of the presence of a malignant growth of the prostate. These bony deposits resist radiotherapy.

Melanomata.

In each patient treated for melanoma the diagnosis was supported histologically. The majority gave a history of an early, rapid and wide dissemination of metastases with local recurrence following the surgical removal of what had been a simple, disfiguring dark mole of years' standing. The patients' ages varied from twenty-five to fifty-nine years. Males predominated. Radiotherapy did not influence these growths in the slightest degree, even temporarily.

Emphasis is laid by these experiences on the necessity for care and caution in interfering with pigmented moles by ill-planned surgery. Recent investigations into the histogenesis of these neoplasms makes out an almost indisputable case for their origin in the basal epithelium.

The Skin.

Basal-Celled Growths.

Primary and recurrent basal-celled cutaneous growths involving bone and cartilage were relieved for varying periods, but no cures were established.

Squamous-Celled Growths.

Squamous-celled growths of the skin were inoperable, recurrent examples and proved highly resistant to heavy doses of X rays. Cervical gland metastases lost their fixity for a time, occasionally receded, but renewed growth in spite of treatment was the invariable experience.

The Nose and the Paranasal Sinuses.

The antra were the commonest site for malignant growths of the nose and paranasal sinuses. The

patients' ages ranged from ten to sixty-five years. Histological examinations were not always made. The histories did not indicate any common predisposing or exciting causes. Several patients had been treated for inflammatory sinus disease. Early neoplastic disease had not been recognized in certain instances. The failure to respond to suitable treatment prompted further investigation when the true nature of the condition was revealed.

Swelling, pain and discharge were relieved by deep therapy. The rapidly growing, sarcomatous growths receded more effectively. A child suffering with an antral sarcoma remained well for eighteen months. The cancerous types tended to resist heavy and repeated irradiation. Some patients were treated with embedded radium as an adjuvant. Little or no difference in the response was noticed. Radium appeared to increase the tendency to hæmorrhage. Diathermy was used to remove certain tumours before the radiation was applied. Disagreeable sloughing was an upsetting feature during the after treatment in some cases.

A large postnasal sarcoma disappeared completely after a course of deep therapy. Without local recurrence abdominal metastases caused death six months after the treatment.

Epilation resulted when the hair-bearing areas were exposed to the rays. The hair usually returned if the dose was not repeated. Permanent baldness followed two courses of treatment.

THE LARYNX.

The majority of the laryngeal lesions occurred in males of cancer age. Clinically the growths were inoperable carcinomata and included intrinsic and extrinsic types. Preceding chronic laryngitis was common. The cervical glands were usually invaded. In the routine treatment no attempt was made to fill in the irregularities of the neck with a view to getting a more even distribution of the rays in the structures being exposed. A previous tracheotomy had been performed in a few instances on account of obstruction. No œdema resulted from any irradiation necessitating tracheotomy for its relief. The first course of treatment usually benefited the patient. Both tumour and glands improved, but the signs and symptoms returned after three to nine months and further exposures were futile.

THE LUNGS.

Primary Growths.

The differential diagnosis of primary growths of the lungs is extremely difficult. The patients were in good health as a rule with a short history of respiratory ailment. Dyspnœa was common and at times boring pain deep in the thorax was present. The signs of mediastinal obstruction with pleural effusion were demonstrated in most patients. Sputum analysis gave little help. There is no definite radiographic picture for each type of lung neoplasm and the question of malignant disease cannot always be settled by this means. The appearances alter from time to time in each patient, depending on the degree of bronchial obstruction, lung collapse and disintegration and the amount of pleural effusion at the time of examination. Similar appearances and alterations accompany other intrathoracic diseases. The patients treated were suffering from bronchogenic carcinomata and they derived no benefit.

Secondary Growths.

Pulmonary metastases usually contraindicated radiotherapy. When lung lesions were treated for palliation, success was uncertain.

THE MOUTH.

The Lips.

With the lesion localized to the skin of the lips deep therapy given in maximum doses at one sitting produced apparent cure. With the mucosa involved the result was not permanent. The patients treated for this type of growth had had previous surgical operations following which the growth had recurred. Postoperative irradiation was given to several patients from whom a warty lip growth with cancerous changes had been removed surgically. The information available warrants no conclusions as to the value of this procedure.

The inoperable and recurrent lesions were scarcely affected by deep therapy. More promising results followed radium puncture in several instances. With suitable technique radium therapy competes successfully with surgery in operable lip epitheliomata. It is the treatment of choice when the disease is inoperable. Surgery appears to offer better prospects in dealing with glandular extensions. Block dissection of the cervical glands even before they are palpable seems to be the safest routine, as in the case of intraoral epitheliomata generally. Suitable prophylactic irradiation has its place as an adjuvant to the surgical measures.

The Tongue.

The tongue lesions were hopeless primary and recurrent ulcerating epitheliomata. Deep therapy did not influence the course of the disease in any instance, even momentarily.

The Tonsil.

The first treatment always produced a dramatic, complete disappearance of lympho-sarcoma of the tonsil. In one patient three courses of treatment were given for local recurrences with beneficial results on each occasion. The condition reappeared and passed out of the influence of further radiation.

The rapid disappearance of these tumours after X ray treatment is a valuable diagnostic sign. The carcinomatous lesions resist deep therapy.

The Floor of the Mouth.

Epitheliomata of the floor of the mouth were in males aged from thirty-five to fifty-five years. They were ulcerated, bathed in an infected discharge and extending rapidly in the underlying structures. One patient exhibited no response to deep therapy and radium. His mandible had been attacked and a

malignant sinus exposed the tongue. Another man, aged thirty-seven years, had several applications of low voltage therapy before he was referred for deep therapy. His serum did not react to the Wassermann test. He had worked as a carpet layer with the habit of holding his tacks under his tongue while at his occupation for fifteen years. The growth involved the lower jaw and had ulcerated through the left cheek in the premolar region. He was given a course of intravenous injections of arsenic followed by a full dose of deep therapy. The condition so improved that a wide surgical removal became justified. His subsequent history is unknown to me. A third man had extensive destruction of his mandible around the symphysis with deposits in the cervical glands. The response to the Wassermann test was positive. Histologically the tumour was a squamous epithelioma. Two doses of deep therapy administered with two months' interval had no effect. An abscess developed in the growth. This healed after evacuation. Intravenous injections of arsenic were given without appreciable improvement. Then a third dose of deep therapy was applied and a decided diminution in the cancer resulted. After a short time it recurred and resisted further irradiation.

The Palate.

Epitheliomata situated in both the hard and soft palates did not respond to deep therapy. Surface applications of radium held in position on specially constructed dental plates produced improvement for variable periods. The lesions treated usually involved the bone extensively and had had surgical and diathermic treatment.

In more recent times the radiotherapy of intraoral new growths has been more successful. This has been brought about by a more vigorous use of radium. The element embedded in the growth gives the best results at present and a careful selection of the amount of radium and the duration of the exposure in each instance promises to make this method of treatment the procedure of choice even with operable tumours. The chief hindrance to efficient irradiation of intraoral neoplasms is the small margin in radio-sensitivity between the growth and its tissue of origin. The discovery of an agent that would sensitize the malign cells to radiation selectively would mark a great advance in the use of X rays and radium in these lesions. Arsenic appeared to accomplish this effect in the instances cited. Further difficulty arises from the early spread and dissemination of these new growths and efforts to irradiate the lesions completely are prone to cause radiation wounds of bone and vessels which are particularly troublesome, as they are readily infected.

Deep therapy in my hands has not been of much use in the treatment of the glandular metastases. Others report encouragingly on the method of applying radium in a plastic support externally to these deposits.

The Salivary Glands.

Nearly all of the lesions of the salivary glands were in the parotid gland. Histologically the majority belonged to the mixed tumour type. Recurrent and primarily inoperable growths were treated by deep therapy. The immediate response was usually highly pleasing, as definite regression of the tumour occurred. The end results were disappointing, as local recurrences and wide-spread metastases were not uncommon.

Peritoneal Sarcomatosis.

Deep therapy was of no value in checking the progress of an odd example or two of peritoneal sarcomatosis, an uncommon disease.

Branchiogenic Carcinoma.

Malignant cysts of the neck were uninfluenced by deep therapy.

The Lymphatic Glands.

Lymphosarcoma.

A spectacular regression of lymphosarcomata follows the first treatment. Eventually they recur and although further exposures obtain a temporarily satisfactory result, a time comes (perhaps in years) when this power of control is lost.

Carcinoma.

Carcinomata of lymphatic glands have been mentioned with the breast and oral new growths. The aortic glands when invaded by extensions from seminomata of the testicle are usually radiosensitive without being curable.

The Spleen.

A young man, aged twenty-four years, had an enlarged, nodular, adherent, stony hard spleen. Laparotomy revealed that there was an inoperable tumour. No histological examination was made. The blood count did not reveal any definite information. No glandular tumours were present. Deep therapy did not alter the clinical picture.

The Thyreoid Gland.

The patients treated with cancer of the thyreoid gland were females. The diagnosis was based clinically on the sudden onset of tumour with rapid growth, pain and local infiltration with pressure effects. No visceral or bony secondary deposits came under notice. The response to deep therapy was unsatisfactory. Adequate irradiation with radium was not possible.

In one instance the patient remained under observation for some time. Her tumour ruptured through the skin, discharging a large quantity of fluid with considerable relief of symptoms. It is likely that the diagnosis should have been cystic goître.

The Bones.

Primary Growths.

Recent investigations have emphasized the extreme difficulty in making a correct clinical diagnosis in primary malignant tumours of bone. The

histologist is often in doubt. He needs to consider the history and radiographic findings in many instances before offering an interpretation of the microscopical appearances as atypical forms are not uncommon. The final diagnosis is made after careful consideration of all the available data. On account of the well known, wide differences in prognosis and treatment between the several varieties of these growths, the clinician requires to know more than that he is dealing with a bone sarcoma.

Pain is an important early symptom. Any obscure, persistent bone pain brings bone sarcoma into the differential diagnosis. Trauma is a causative agent of giant-celled tumours. Some authorities regard these conditions as faulty repair phenomena rather than as new growths.

The American Registry of Bone Sarcoma has done a great service in its attempt to classify bone tumours. Certain atypical conditions cannot be classified in the present state of pathological knowledge, but acceptance and use of the nomenclature and suggested classification of the Registry will clarify reports and discussions on this subject.

Osteogenic Sarcoma.

In the present state of knowledge and considering past experience, amputation should be advised when this diagnosis is made. This applies to all varieties of the subperiosteal and medullary types. Patients with advanced as well as early lesions have occasionally been cured by this treatment. Deep therapy cannot be regarded as an alternative. In reported cures by radiation therapy it has to be borne in mind that the tumour might have represented an atypical type of which the degree of malignancy is still unknown.

Giant-Celled Tumour.

Radiotherapy has proved of decided value in many cases. It may fail if the tumour is unduly bulky or vascular or of unexpected malignancy. Even then surgical treatment can be undertaken without an alteration of the prognosis. The radio-reaction of these tumours is of diagnostic use. After full doses the radio-sensitive types exhibit an apparent radiographic and clinical extension of the disease. This effect usually ceases after six weeks and in two or three months lime salts commence to be deposited in the affected area. It may require up to two years for this process to reach completion. A pathological fracture occurred in one patient at the site of the growth (lower end of femur) during the reactive period. It healed without impairing the end result. Several patients had had the tumours curetted before the course of radiotherapy. It is doubtful if this procedure is necessary as a routine. With less than full doses repair may be expected without preliminary extension of the amount of bone destruction.

Ewing's Tumour (Endothelial Myeloma.)

There is a definite early response when deep therapy is applied to Ewing's tumour (endothelial myeloma). This is of value in diagnosis in doubtful cases. Recurrence is the rule and although others claim cures, it appears to be wiser to urge amputation as dissemination is common. The close resemblance of this new growth in its early stages to chronic infective osteitis has to be kept in mind to avoid delay in diagnosis.

Fibrosarcoma.

Fibrosarcomata vary in radio-sensitivity. The cellular varieties are more easily influenced by radiotherapy. As a group they are radio-resistant and are better treated by amputation. Local resection is usually followed by a more malignant recurrence. Such recurrences are not amenable to deep therapy.

Secondary Growths.

The secondary lesions treated represented different types of secondary deposits from mammary, renal and prostatic neoplasms. Deep therapy did not alter the course of the disease in any patient. With certain mammary and prostatic metastases there appeared to be radiographic evidence of bone regeneration following the treatment, but as there are osteoblastic types of reaction to the presence of these cancerous emboli in the bones, it would be illogical to credit the deep therapy with the appearances of repair noted in these patients. Irradiation can be expected to relieve the pain in most instances.

THE EFFECTS AND PRACTICAL USES OF THERAPEUTIC RADIATION.

The methods of applying radiation vary widely. It is agreed generally that the total dose delivered to the tumour must be of the order of from 100% to 150% erythema skin dose without overdosage of the healthy tissues. It is not possible to support the idea of a curative cancer dose.

Dosage.

Full Doses.

A single full dose may be given. This aims at destroying the tumour cells at once and so is theoretically the ideal method. In practice it is not uniformly successful, owing to the variability in tumour radio-sensitivity and the unknown factors determining a favourable reaction in the tumour bed. Underdosage may be harmful and overdosage with damage to important healthy surroundings has to be strenuously avoided.

Prolonged Exposure.

Prolonged single exposures to small doses of radiation are used when restraint of tumour growth is the aim of treatment. It provokes the least tissue reaction and is of value when palliation of symptoms is sought.

Repeated Small Doses.

The majority of radiation treatments nowadays are given in smaller doses at intervals. The full dose is completed in one to three weeks, usually ten days. There are no fixed principles for guidance to enable one to select the best division of the dose or the most suitable intervals between each part

of the dose. Notice is taken of two facts: (i) That the effects of the radiation are cumulative and (ii) that such a method attacks successive groups of cells in different phases of their life cycle. It is undecided whether the cells are sensitized or otherwise by preceding exposures when this course is adopted. There is some loss of radiation effects with these divided doses. This is overcome by increasing the total dose delivered. Severe tissue reactions can be obtained by these applications and many failures are due to the destruction of normal repair processes in areas with an insufficient blood supply following surgery or previous irradiation.

Saturation Method.

Clinically it is the exception for a tumour which has temporarily regressed, to show continued improvement from a second application of radiation once the power for renewed growth has been reestablished. The saturation method of dosage has been introduced to overcome this behaviour of tumour growth. A full erythema dose is given to the neoplasm in single or divided doses and the effect maintained for a certain time by giving additional doses to make up the loss in effect during any given period. It assumes that the radiation effect is lost in a constant manner and calculations are made to determine the intensity of radiation necessary at any time to return the quantity in the tissues and tumour to its saturation level.

The object is to keep the malignant cells saturated during the whole period of their sensitivity. It is usual to reach saturation quickly and maintain it for about fourteen days. The technique is difficult and accuracy in dosage and cross-firing is essential. Certain workers are convinced that their results have been improved by the use of this method. I have no personal experience of its value in practice. There are certain theoretical objections to it. It is time-consuming and at present it is not possible to decide correctly the time during which saturation should be maintained. It would seem to vary with the histological characters of the tumour among other factors.

The calculations for estimating the quantity of radiation to be used each time for restoring saturation level are based on the laws operating between X rays and their absorption by matter. It is difficult to connect these laws with conditions obtaining in pathological tissues.

If the method is not of universal application, it is possible that certain types of new growths will be benefited by its use where other procedures fail.

Low Intensity Currents.

A local and general lymphocytosis has been observed experimentally and clinically in instances of tumour regression. The ability of generalized X ray exposures of low intensity to produce lymphocytosis has long been recognized. Recently their use in this manner in the treatment of cancer has been advocated. We know, however, that cancer grows rapidly in the young in spite of vigorous activity of the lymphatic system.

Good results may be obtained by any method. The importance of correct dosage is therefore evident. The reasons for the differences in effects with different divisions of the doses, with high and low voltage technique and with different tumours and different time spacings are not known. The hypothesis that divided doses are better because they affect more nuclei in a susceptible phase of mitosis is not supported by clinical results. Adequate single massive doses produce just as good results as divided doses.

The Radio-Sensitivity of Normal and Neoplastic Tissues.

The Skin.

The radio-reaction of the skin is subject to wide variations. Small doses cause no visible effect, larger doses produce epilation and erythema. Such a reaction appearing in seven days and gradually fading and leaving a brownish discoloration after three weeks, is the biological standard of dosage of wide usage referred to as an erythema skin dose. After such a reaction the hair may grow again. With excessive doses the erythema appears earlier and instead of it subsiding, blistering occurs and intractable ulceration may follow.

With deep therapy an œdematous condition of the skin and subcutaneous tissues is observed at times as part of the reaction. Repeated irradiation can bring about an atrophic state of the skin with permanent alopecia and loss of function of the sweat and sebaceous glands even without producing an erythema. Repeated doses of deep therapy cause a brawny induration of the skin and underlying tissues with lasting pigmentation. Obliterating endarteritis cuts off the blood supply and eventually the parenchyma is replaced by fibrous tissue. Telangiectases are common sequelæ in skin areas subjected to many exposures. The atrophic, debased skin is easily traumatized.

The skin of different parts of the body differs in its radio-sensitivity. The anal fold and the neck are most susceptible and the palms of the hands and the soles of the feet most resistant. Irritant chemical dressings increase the sensitiveness, whether used before or after the radiation exposures.

Certain systemic diseases have a similar effect. Thyreotoxicosis may be cited as an example. In cachectic states relatively more radiation is required to obtain a skin erythema, but ulceration occurs more readily with repeated doses. No instance of radiation idiosyncrasy was observed. It must be an exceedingly rare condition.

The Effects Produced by Therapeutic Radiation.

The Glandular Organs.

Salivary and Mucous Glands.

Heavy doses of deep therapy cause a definite dryness of the mouth. This persists after repeated exposures.

Ovaries and Testes.

One-third of an erythema dose delivered to the ovaries induces menopausal changes. Full and repeated doses render the changes permanent.

Under these conditions the ovary is reduced in size and the Graafian follicles degenerate. The primary follicles undergo the most intense changes and usually they disappear completely. In the more mature forms deterioration of the epithelium of the follicle occurs with loss of the ovum. Capillary hæmorrhages appear in the stroma. The ability to regenerate is destroyed.

Similar exposures of the testes produce atrophy of the seminal cells.

Spleen.

The Malpighian bodies are readily damaged. Their cellular elements degenerate. The central arteriole shows signs of endarteritis and periarteritis. The pulp spaces are dilated and their lining cells deteriorate. Myeloid metaplasia occurs, especially around the fibrous trabeculæ and under the capsule. The blood picture reveals a diminution in lymphocytes. The clotting time of the blood is reduced. Minor injuries are repaired. Permanent damage follows heavy irradiation.

Liver.

Degenerative changes of the liver follow even small doses. Profound metabolic disturbances are the result. Certain alterations in the blood chemistry have been noticed in irradiated animals. There is an immediate temporary increase of rest nitrogen and amino-acids signifying the destruction of protoplasm. Urea is increased, showing that the ability to form this substance is retained by the liver. There is an increase of sugar representing glycogen mobilization. Later the liver atrophies and glycogen decreases, while urea persists. It seems that owing to protein destruction sugars and fats are used in its stead. This is supported by the loss of liver glycogen, the loss of body weight (fat) with an increase in blood lipoids.

The Nervous System.

Nervous tissues are apparently insensitive to the usual therapeutic doses.

The Osseous System.

Repeated exposures to full doses of radiation may cause chronic osteitis. Necrosis ensues from the prolonged action of radium in the vicinity of bone. The growth of long bones may be checked if the epiphyseal areas are subjected to several deep therapy exposures.

In the marrow the essential blood cells are destroyed. The myelocytes and maturer forms are injured and so the sources of blood regeneration are diminished. Myeloblasts are scanty in adult marrow. Regeneration is slow, as the blood cells are derived from the proliferation of the myelocytes. The fatty tissue does not appear to be harmed by the rays.

The Blood and Lymph Vessels.

There is an early vascular dilatation which accounts for the hyperæmia in the exposed area. Later the vessels tend to be occluded by obliterating endarteritis. The beneficial results of successful radiotherapy are considered by some workers to be due to this effect of the radiation. This effect is sought when radiotherapy is used to control hæmorrhage or to diminish the risk of dissemination by way of the blood or lymph channels. In practice the latter aim is difficult to achieve, as normal lymph vessels are not affected by the doses of radiation used in clinical applications.

The Lymphatic System.

Normal lymphoid tissue is not unduly sensitive to therapeutic doses of radiation. Small doses produce a local and general lymphocytosis. With full doses there is destruction of the lymphocytes contained in the glands as well as in the blood stream. This explains the better effect noticed clinically on the superficial glands with their bulky cortices, than on the deep glands with their scanty cortices. Radiation applied to cancerous deposits in a lymphatic gland with an intact capsule produces closure of the blood supply, sclerosis of the capsule and necrosis of the cancer cells. Radiation is generally ineffectual if the gland capsule is ruptured by the disease processes.

The lymphoid tissues have a distinct power of regeneration, so that the lymphocytes are soon replaced after therapeutic doses. Animals exposed to heavy experimental irradiation suffer irreparable damage to the lymphatic system and early death ensues.

Hyperplastic and neoplastic lymphoid tissues are extremely sensitive to X ray exposures. A resistance is usually established which increases with further treatments.

The Thymus.

Regeneration follows small doses. Heavy doses destroy the thymic cells which are replaced by fibrous tissue.

The Lungs and Pleura.

The effects produced in these organs have been referred to when the treatment of mammary and intrathoracic neoplasms was being discussed. Pleuro-pulmonitis results from therapeutic doses. Recovery follows the first application. Repeated reactions induce a dense, massive pleuro-pulmonary fibrosis with impairment of pulmonary function and traction displacement of the thoracic contents. Cardiac embarrassment may be a result.

The Heart.

No direct disabling damage is done to the heart tissues by therapeutic doses.

The Blood.

The red cells, granulocytes and monocytes arise from the bone marrow, the lymphocytes from the lymphatic tissues. Irradiation produces leucopenia with relative lymphocytosis. In chronic conditions this picture may persist for years without any evident gross damage to the myeloid tissues.

Suitable doses of radiation will produce an actual increase in the number of lymphocytes. If irradiation decreases the lymphocytes, the prognosis is grave. Neutrophilia and eosinophilia accompany myeloid hyperplasia. Long continued exposures produce aplastic anæmia. Leucopenia persisting in spite of myeloid hyperplasia is more common and results from cell destruction taking place in the circulation. The other form following generalized damage to the blood-forming system is rarer and usually associated with fatal cases. There is probably more than the direct action of the radiation at work in these instances. The destroyed leucocytes may release a toxin (leucotoxin) which helps to produces these qualitative as well as quantitative blood changes.

Soon after exposure to therapeutic radiation the acidity of the blood rises. This stimulates respiration and lowers carbon dioxide tension. The blood reaction soon returns to normal (one hour) and an alkalosis ensues and persists for several days. Repeated exposures in this period do not increase the acidity. There is a temporary increase in the water content of the serum. Chlorides decrease out of proportion to the water increase due to the local œdema. Potassium and sodium increase more than the chlorides or bicarbonates. Potassium never decreases. Calcium decreases slightly. There is an upset of the potassium-phosphorus-calcium equilibrium.

Sedimentation of erythrocytes is retarded after medium and heavy doses of radiation, indicating an alteration in the suspension stability of the blood plasma.

Minimal doses raise the opsonic index of the blood, while excessive doses tend to destroy it.

Enzyme Activity.

The action of radiation on enzyme activity is not known with certainty. The opinions expressed are very conflicting. This is due to several causes, including differences in technique and dosage with some experiments done in the zymogen stage and others with the fully formed enzyme.

There are similar variations in the degrees of radio-sensitivity of neoplastic tissues. The readiness with which a tumour is influenced by irradiation, is no criterion to its curability by this form of treatment. Tumour radio-sensitivity depends on several factors which include the following:

(*a*) Cell morphology and degree of tumour vascularity. As a rule the rapidly growing, vascular, embryonic types are most easily affected. Ewing's classification of neoplasms according to their histology and in the order of their radio-sensitivity is as follows: (i) Lymphoma, (ii) embryonal tumours, (iii) cellular anaplastic tumours, (iv) basal-celled carcinoma, (v) adeno-carcinoma, (vi) squamous-celled carcinoma, fibro-sarcoma, (vii) fibroblastic sarcoma, osteosarcoma and neuro-sarcoma. Each group contains subgroups also distinguishable by their reaction to irradiation. Histological studies of irradiated specimens have revealed a connexion between the radio-sensitivity of certain tumours (*cervix uteri*, breast) and their degree of malignancy which depends on certain intracellular and extracellular phenomena (degree of differentiation, lymphocytosis, fibrous tissue reaction). This index of malignancy is of value in prognosis and helpful in selecting tumours suitable for radiotherapy.

(*b*) Phase of life cycle of the cell. It was thought that cells were more susceptible to irradiation during their division. Strangeways, however, did not notice this sensitivity in his investigations. He found that suitable irradiation prevented the majority of the exposed cells from coming into mitosis. Even if radiation effects appear to be more readily secured during cell division, it does not necessarily mean that the nucleus is the site of action of the rays. The changes in the cytoplasm and cell and nuclear membranes at this time are equally important and may hold the explanation of the sensitivity exhibited during this period.

Apparently the physiological processes of the cell (growth rather than specific function) are more susceptible to irradiation in the phase immediately preceding the visible prophase. The effect seems to be always injurious to the cell.

(*c*) Chemical composition of the cell. This varies from point to point in the cell and with the metabolic activity of the cell. There is a great deal of clinical and histological evidence to support the view that the biological reaction to irradiation depends on the activity of cell and tissue metabolism as much if not more than on morphological types.

Cell metabolism in infancy differs from that in maturity and old age. The factors underlying growth stimulation and inhibition alter with age. The importance of the intracellular and extracellular agents producing these differences is fully realized, but their mode of action is not clearly understood. The chemical composition of a cell determines the quality and quantity of radiation that it is capable of absorbing. This explains the differential action of radiations of different quality.

(*d*) General good health is essential to favourable results. Blood regeneration must be efficient and the eliminative organs functioning normally. Anæmia, nephritis and cardio-vascular disease militate against a successful issue.

(*e*) The optimum reaction to irradiation requires an adequate local blood supply and absence of irritation in the treated area. Previous irradiation and acute or chronic inflammation, especially syphilitic, reduce radio-sensitivity.

When a favourable response to irradiation is obtained, the further growth of the tumour is checked; the malignant cells degenerate and are replaced by a healthy cicatrix. In human carcinomata several more or less defined stages in this process have been described.

(i) For a period of varying length no gross macroscopical changes can be discerned. The length of time depends on the quality and quantity of radiation, its mode of application and the factors con-

trolling tumour sensitivity. Usually it lasts from six to fifteen days. Hyperæmia accompanied by an exudate of serum or blood may occur in the irradiated area.

(ii) The cells and their nuclei become enlarged and develop monstrous stigmata and cytoplasmic hydrops ensues. Microscopically it appears that a few of the cells are killed during the exposure. The majority, however, live for some time before they die. Full doses cause mitoses to disappear. The ability to divide returns (hours) and gradually becomes more active until it is even more evident than before the irradiation (days). Cells dividing during the exposure may continue to divide apparently in a normal fashion before mitosis ceases. The renewed mitoses may be typical or atypical and the enlarged nuclei are hyperchromatic.

The recurrences seen in over-irradiated scar tissue and the failure to obtain a beneficial response after repeated exposures show that some cells may recover from the damage they sustain.

(iii) Complete or irregular keratinization occurs in the cells.

(iv) The malignant cells become disorganized. Lymphocytes and plasma cells attack the *débris* and remove it from the treated area. The lymphocytes are prominent in this aspect of cancer defence. It is claimed that the greater the lymphocytosis, the better is the prospect of a good end result. The lymphocytes are more effective within the lymphatic glands. Cancer growths do not invade plasma cells which apparently produce conditions inimical to their spread. Endothelial tissue leucocytes are not greatly concerned in these reactions.

(v) Fibroblasts and new capillaries fill the tumour region and finally a healthy, avascular scar remains. This connective tissue activity is considered by some authorities to represent a stimulation of the normal repair forces of the body by the radiation. It is more likely that this replacement of the destroyed tumour by connective tissue follows a main law of general pathology. The literature contains several references to the strangulation of tumour cells by connective tissue bands resulting from the irradiation. This method of removing neoplastic disease probably never operates. It is more reasonable to think that in all instances the removal of malignant cells requires the radiation to set in motion the changes already detailed.

Tumours other than carcinomata present different nuclear changes. In lymphoid and embryonal cells pycnosis, shrinking and karyorrhexis of the nucleus occur. The abundant small nuclei break up into granules which become dispersed in the tissue and body fluids. The rapid disintegration of large lympho-sarcomatous deposits without constitutional distress indicates that these nuclear products do not cause any great degree of intoxication. The cells of an irradiated sarcoma may become of a benign connective tissue type.

Many of the effects observed in practical radiotherapy are caused by the altered blood supply resulting from the *endarteritis obliterans*. The lymph vessels are not easily affected by therapeutic doses. This is perhaps a factor in the failure of irradiation to restrain tumour dissemination. With unsuccessful irradiation it is not uncommon to find degenerative changes in the tumour bed. The radioresistance of a tumour need not represent a specific change in the cancer cell. It could be explained by a failure to preserve intact the environment of the tumour.

When the progress of the growth becomes reestablished, it is the rule with very few exceptions for even heroic doses of radiation to be unsuccessful in securing further benefit. At present we have no means of resensitizing the tumour so that the initial improvement may be repeated and the cumulative effects of successive treatments used to control its growth indefinitely.

My experience does not cover an instance in which stimulation of the growth followed as a result of the irradiation. If a temporary regression was not obtained, the tumour grew at a rate comparable to that of untreated tumour. At times an apparent stimulation is observed and reported, but consideration usually shows that it can be explained as readily as a secondary effect following a primarily detrimental action of the radiation on the surrounding tissues. In the same way the secretory activity of glands after radiotherapy is of a compensatory nature rather than a direct stimulation of function. Microscopical studies made of specimens showing tumour regression after irradiation have not helped in revealing the site of radiation action or what appearances indicate that a certain reaction will continue to a cure of the lesion. Prognosis may be aided by a knowledge of the histology of the tumour, but such information gives no suggestion as to how radiotherapeutic technique could be altered, so that a good result would follow in disease with a poor prognosis. The microscope is too crude an instrument when intraatomic alterations are being investigated.

Radiation Intoxication.

The constitutional effects of radiation vary in different individuals. Their determination and control are uncertain. The symptoms commenced as a rule during treatment and disappeared completely in a week without special treatment. Pulse and respiration rates were raised with mild pyrexia at times. Painful diarrhœa with mucus and blood occurred in a certain number of patients. These complaints were more troublesome when the abdomen, especially the epigastrium, was exposed.

With fractional doses or when high *milliampèrage* and short exposure were used, these minor upsets were much less noticeable. No patient with grave constitutional disturbance of delayed onset has come within my experience. The symptoms are those of a mildly toxic state. Several hypotheses have been suggested to explain them. None, however, is wholly satisfactory, as each fails to cover all the conditions and circumstances of the disorder. The presence of

ozone and noxious nitrous gases in badly ventilated rooms has been blamed. Radium workers report these ill effects in patients treated with heavy doses of radium radiation. Therefore these factors cannot be wholly responsible for the intoxication.

The high electrical charge induced in the patients' bodies is supported by some observers as the cause of the condition. They connect their patients to earth as a prophylactic. The danger of this procedure appears to outweigh any benefits it may afford. The objection to the previous theory also applies to this one.

Others use an increase in the urinary protein derivatives as evidence to attribute the prostration to the release of poisonous substances from the destroyed tissue and blood cells. Others limit the cause of the effects to the result of exposing the alimentary tract. This is supported by the report of a *post mortem* examination of a patient who died from the acute distress occasioned by a course of deep therapy. Both intestines were extensively ulcerated. It is also possible, however, that these findings represent the results rather than the causes of the disorder.

Acidosis has been held responsible for the symptoms, but exhaustive biochemical analyses have failed to produce constant evidence to uphold this view. At times the condition resembles an anaphylactic shock and in such circumstances the proteins liberated from the irradiated tissues are considered to be the cause. The clinical fact that the effects follow the first exposure with a loss of susceptibility to subsequent exposures is against anaphylactic phenomena as the explanation of what happens in these patients. The general reaction in certain leuchæmic patients has been noticed to increase in severity with repeated treatments. It is possible that they are sensitized in some way by the products of the irradiated leucocytes.

These protein products are also held as the agents directly producing the intoxication. It is well known that these substances resulting from necrosis and autolysis do cause toxic symptoms. Clinical experience is favourable to this suggestion. When the liver is exposed, the depression of bodily vigour is aggravated. *Post mortem* studies do not indicate clearly the reason for this observation. Perhaps there is interference with its detoxicating functions. It is also conceivable that injury to the intestinal mucosa allows decomposition products from the alimentary tract entering the portal circulation to add to the toxæmia.

Radiation Physics and Dosage.

In the present state of knowledge attempts to visualize all the processes involved in the successful irradiation of a new growth are rather speculative. The absorption of therapeutic doses of radiation is a function of the electrons in the atoms and molecules of the chemical constituents of the cells. The method of transformation of radiation energy to forms suitable for influencing the vital activities of the cells is not understood. It is apparently connected with the release and absorption of corpuscular rays (electrons).

The atom tends to remain in a state of minimum potential energy. Work must be done to remove an electron from any particular energy level. When an electron moves from one level to another close to the nucleus, a spectral line (radiation) is emitted. When radiation is absorbed a resonant electron is transferred to an outer level. With the absorption of X rays or γ rays it appears that the electron is removed from the atom entirely.

The electrons can move in one of several stable orbits according to the state of stimulation or otherwise of the atom, so that atoms of the same element can exist in states in which the electronic levels are not identical. This makes the subject of radiation emission and absorption one of great complexity. The region of the atom connected with X radiation is well defined and is placed midway between the outer levels concerned with ionization and chemical combination and the inner and nuclear electrons of radio-activity.

Many attempts have been made to determine the essential nature of radiation. Light was used in the experiments and wide acceptance was given to the wave theory which visualized the rays as spreading undulations of varying wave lengths disturbing the electrical and magnetic components of the ether. Recent research with more refined technique has proved that X rays can be totally reflected, refracted in passage through prisms and diffracted by ruled gratings. These findings are adequately explained by a spreading wave theory and are used to identify light and X rays with radiation in general.

However, the increased frequencies of X rays have brought certain electrical and energy phenomena into prominence. The wave hypothesis fails to explain certain of these observations. Compton has noticed an increase in wave length when hard X rays are scattered by matter. An explanation is offered by Planck's quantum theory which regards the radiation as made up of discrete discontinuous bundles of energy. The Compton effect is looked on as being due to the loss of a certain quantity of energy from the X ray quantum in its collision with an electron in the irradiated body. The amount of energy lost and the directions of the scattered ray of increased wave length and the recoil electron are determined by factors, such as the quality of the incident ray and the angle of scattering.

The quantum theory states that a definite quantity of kinetic energy is carried by each periodic wave and this energy can reappear in the form of energy possessed by electrons in rapid motion. The emission of radiations from atoms and their absorption take place in definite quantities of energy, namely the frequency of the radiation (ν) times Planck's constant (h). To β rays are allotted quanta equal to their kinetic energy divided by Planck's constant. This gives the frequency of the absorption discontinuity (quantum) that a β ray

of quantum $h\nu$ can just excite. This reconciles the undulatory and corpuscular hypotheses. Radiation may appear as a kinetic manifestation or it can exhibit the phenomena characteristic of spreading waves. The change from one form to the other obeys laws expressed as a transference of the quantum of energy.

When X rays enter matter, three effects may be noticed. A percentage of the radiation passes through the object without alteration. The amount so uninfluenced depends on several factors including the quality and intensity of the radiation and the density and thickness of the irradiated body. A certain quantity of the radiation is dispersed without change. A proportion is absorbed and as a result secondary undulatory and corpuscular rays are emitted. These waves are characteristic of the irradiated body and can be used to identify it. Their quality depends on the composition of the radiator and the quality of the incident beam. Each corpuscular ray has an energy value comparable with that of the electron in the X ray tube which excites the radiation responsible for its liberation. It depends on the frequency and not the intensity of the radiation.

The scattering factor is important with light elements, such as are present in living tissues. With soft rays it is not so important as true absorption, but with hard rays it is preeminent.

The amount of radiation reaching any part compared with that reaching another part varies inversely as the squares of the distances of each part from the source of radiation. With homogeneous rays the same percentage of incident beams is absorbed in each layer of similar depth, the absorbed radiation being proportional to that transmitted. Radiation of longer wave length is more strongly absorbed in the upper layers when beams of equal intensity and unequal wave length are compared. The energy absorbed in the different depths decreases rapidly with long wave lengths.

The scattered radiation following paths in all directions affects the distribution of energy in the depths to a great extent. It is of longer wave length than the exciting radiation and increases the surface and depth intensities in degrees depending on the density and thickness of the irradiated body and the quality of the primary radiation. The radiation which leaves the body without being absorbed, produces no effects in the tissues.

The absorption of radiation increases the potential energy of the electronic systems of the atom, resulting in alterations of electrical equilibrium. It is conceivable that biological effects follow when these changes affect the colloidal structures of protoplasm.

DOSIMETRY.

Practical X ray dosage presents many difficulties. The clinician has been confused by the variety of suggested dosage units and the diversity of devices available for measuring radiation quality and quantity. In the present day efforts to standardize X ray dosage the disabilities of practice under these conditions are realized and their fulfilment will remove many of the misunderstandings of the past.

The discussion of X ray dosage involves biological and physical considerations. Since only the absorbed radiation produces biological effects, it is desirable to know the dose at every point in the tissues irradiated. As the radiation quality is altered in its passage through the body, it is extremely difficult to measure the amount absorbed in any volume in a given time. Even with this information available the absolute dose at any point would depend still further on a knowledge of whether all the absorbed rays are necessary for the biological reaction or whether a certain intensity or quality or combination of intensity and quality is required to produce the effects.

At present these questions cannot be answered, so that radiation is not measurable in terms of its biological effects.

Although practical use is made of the skin effect as a criterion of the biological action of the rays, it is understood that a knowledge of the surface intensity, however intimate, does not warrant any reliable deductions connecting the absorbed, effective radiation with the biological reactions.

The physical aspect of dosage deals with the quality and quantity of the radiation used. There is no satisfactory, practical, direct way of measuring the radiation energy. The methods in use require a transformation of the primary energy and they register the magnitude of some secondary effect.

The Quality of the Radiation.

The quality of any particular beam of therapeutic radiation may be expressed by stating its coefficient of absorption, its half value layer or its effective wave length, the peak voltage, the filtration and the type of high tension apparatus.

The estimations of the coefficient of absorption involve the use of laboratory apparatus and are best made by a physicist. It is necessary to detail the methods and filters used, as the calculations vary with the conditions of the recordings.

The peak voltage is measured by sphere gaps of a certain minimum diameter connected parallel with the tube with corrections on account of temperature and atmospheric pressure. The minimum wave length emitted by the tube is related to the peak potential applied to it. It is equal to Planck's constant ($h = 12{\cdot}35$) divided by the peak kilovoltage.

The nature and thickness of the filter material are important factors in controlling the quality of the surface and depth radiations.

Different types of high tension generators emit radiation beams of different intensity and quality. The wave form and phase relations determine to a certain extent the output of pulsating generation.

The X Ray Spectrum.

A typical spectrum comprises a continuous spectrum, the shortest wave length of which depends, as already stated, on the peak of the exciting kilo-

voltage. With two hundred kilovolts this wave length is 0·06 Ångström units. The longest wave length is determined by the amount of filtration and the shape of the voltage curve. The distribution of intensity between these limits varies with the peak voltage, the form of the voltage curve, the filter material and its thickness and the direction of the incident rays. The spectrum also comprises a line or discontinuous spectrum superimposed on the white spectrum. The material emitting the rays is responsible for these lines. Certain critical voltages excite these radiations which are definitely related to the atomic numbers of their generators. In deep therapy these characteristic radiations make the average radiation softer. Filter materials emit their characteristic rays under suitable conditions. Special filters are necessary to eliminate these superimposed soft rays from the incident beam used in therapy.

Experienced physicists often find difficulty in reading the feeble intensity of the minimum wave length on account of the brightness of the spectral band of which it forms the boundary. Spectrographic determinations require great care in their recording and interpretation if error is to be avoided.

With pulsating currents a knowledge of the minimum wave length is not sufficient, since differences in doses measured under apparently uniform conditions may be found on spectral examination to be due to differences in the energy distributions of the spectra. The quality of the range of wave lengths in any radiation beam is all important, because it determines the penetration or absorption coefficient, the scattering coefficient and may be the biological effects. Although the heavily filtered rays used in deep therapy are sometimes referred to in the literature as being homogeneous, the spectrograph shows that such radiation is always heterogeneous.

The spectrograph is of value in studying the quality of therapeutic radiation, but at present it is more suitable for larger laboratories than private clinics.

The radiation quality may also be expressed as the percentage of the surface dose which reaches a depth of ten centimetres in the tissues. The measurements are made with an iontoquantimeter and phantom patient under actual working conditions. The distribution charts used in calculating the percentage of energy delivered to the various depths with different conditions of X ray excitation and filtration are adequate for practical clinical purposes. They show the percentage depth dose along the central and isodose lines and also the change of time necessary when the size of the port of entry is altered.

The depth dose depends on the radiation quality, the target-skin distance and the size of the port of entry. A decrease of intensity occurs at the point of emergence owing to the lack of scattered radiation and the surface dose is increased by back scattering from the underlying tissues.

The Quantity of the Radiation.

Pastilles (Noire, Sabourard), Photographic Paper (Kienbock) and Selenium Cell.

Methods such as pastilles, photographic papers and selenium coils have only a limited application in deep therapy on account of the error of hardness. Each element has a characteristic discontinuity in its absorption curve (absorption coefficient plotted against wave lengths). It lies below the point of characteristic emission and is a region where soft rays are absorbed less than harder rays. If the photographic method is used and radiation of a wave length just above the point of selective absorption in silver is compared with that of a wave length just below this value, it is found that the harder radiation will be measured relatively too strongly. The selenium coil has a similar disadvantage requiring a correction to be made with different wave lengths.

The Erythema Skin Dose.

The erythema skin dose is of wide use in dosimetry. It is a purely subjective method and rests heavily on the personal factor. Great differences in X ray dosage (up to 300%) have been discovered when ionization chamber measurements were used to compare the intensities of radiation required to obtain the desired erythema in different clinics. The inability to relate tumour radiosensitivity with that of the normal skin is a direct result of the variations in sensitivity of pathological and normal tissues in different individuals. Dosage based on these principles is not scientific.

The effects of X rays on animal tumours, sprouting beans and larval forms have been used in attempts to correlate X ray intensity and biological effects for the purposes of calculating accurate dosage. These efforts have not produced much of value for general practice.

Ionization Measurements.

When comparison is made of the absorption curves in air and human tissues of the heterogeneous beams of radiation used in therapy, it is found that they are more or less parallel. This finding forms the basis for the measurement of radiation intensity from its property of producing ionization in air, the degree of ionization bearing a direct relationship to the X ray intensity.

Ionization instruments vary a great deal and up to the present have not been calibrated to a universal standard. In many the calibration of the scale is different for different wave lengths. Instruments to be of practical value should conform in their construction and operation to certain minimal requirements. The dimensions and material forming the air chamber are important items in construction. During operation there is an optimum voltage for obtaining correct results with the saturation current of the air gap. Attention must be paid as well to adequate shielding of the electroscope, earthing the apparatus and allowing for leakage. Periodical calibration is required and this can be done with the use of a constant source of radio-activity.

The ionization measurement is a measure of the absorbed, not the total energy of the incident beam. It is still debated whether the rays responsible for the air ions have any connexion with the biological effects.

It must be remembered that ionization measurements of different wave lengths made with the same instrument may not represent the relative intensities of homogeneous beams of radiation, that radiation beams giving identical readings with one instrument, may not do so with another instrument constructed differently, that harder rays produce fewer ions per unit of energy than soft rays and finally that it does not follow because two radiation beams have the same ionizing power that they produce the same biolcgical effects. These points are not appreciated by all workers.

The International Congress of Radiology has defined the unit of X radiation as "that quantity of X radiation which when the secondary electrons are fully utilized and the wall effect of the chamber is avoided, produces in one cubic centimetre of atmospheric air at 0° C. and 76 centimetres of mercury pressure such a degree of conductivity that one electrostatic unit of charge is measured at saturation current." This unit is called the *r* unit. Universal recognition and use of this unit is delayed until a standard instrument is set up so that the calibration of the instruments in use may be made.

The ionization instruments in use are calibrated in *r* units with a large standard open air chamber. The intensity is reckoned as the product of the *r* units and the time exposure and the scale reads the *r* units per second. For practical purposes these instruments are independent of wave length and provided gross alterations of voltage and filtration are not made, they are reliable in the repetition and reproduction of X ray doses.

In practice dosage is usually recorded in terms of the electrical tube input, the target-skin distance, the filtration and the time of exposure. An ionization instrument is used to check the radiation output of the installation and so one is enabled to maintain constant surface and depth intensity of radiation. The measurements of any type of instrument can be compared only with those of the same type of instrument similarly calibrated. With changes in voltage and filtration the instrument may be used to get an idea of the time exposure necessary to obtain biological effects with the altered factors. The result is confirmed by trial before it is accepted.

In the present state of knowledge an ideal statement of X ray dosage includes the number of *r* units (usually between 800 and 1,200), the shape, size, number and order of the ports of entry, the quality of the radiation and the time of exposure.

It is also more correct to specify the depth dose in similar terms than as a percentage of the surface dose.

A unit or standard dose has not so far been agreed upon, as the problems involved have proved more difficult than was anticipated.

THE CANCER CELL AND CANCER GENESIS.

The literature on cancer abounds in histological details and without wishing to detract from their great value, I should like to advocate the equal importance of closer studies of the manifold clinical aspects of cancer growth, so that its position as a major biological problem would be more widely recognized. While the clinician is mainly interested in describing cancer, he is justified in examining the theories that attempt to explain it on the ground that no hypothesis can be accepted unless he is satisfied that it accounts for all manifestations of the disease as he knows it.

At its initiation cancer is a local lesion. Its local and general permeating and infiltrating properties appear after some time which varies in length under different conditions. No organ of the body is exempt from the disease. It is apparently a new disease in each patient and once started it remains true to type. The instances cited of mutation of an epithelioma to a sarcoma represent more probably occasions where the stroma has become sarcomatous. This finding has been observed only in animals and requires successive implantations.

Cancer seems to be an integral part of its host. Its course is fluctuating. Age, the state of general nutrition, the local blood supply and the metabolic activity of the organ of origin are among the factors which control its progress. Instances of spontaneous cure have been reported, but the disease is usually incurable and proves fatal if the opportunity for early treatment is lost.

It is not likely that the cancer process ever develops suddenly in normal cells. Well defined preliminary alterations precede the onset of neoplastic disease.

Clinical observation indicates that each type of new growth is a distinct pathological entity and it is not always possible to apply findings made regarding one type to other types. The course and termination of each type are similar, but it is difficult to connect the modes of origin of malignant growths in different types. For instance, the commencement of cancerous changes in a pigmented mole differs from that occurring in tumours of the testis or that arising in osteoblastic cells.

Certain occupational cancers have a specific causation. Chronic inflammatory states precede the malignant changes in other instances. Abnormal involution of certain organs is required before cancer appears. Examples are readily gleaned from an analysis of the histological changes accompanying certain prostatic and mammary neoplasms. A small group of cancers seems to have a definite traumatic element in its ætiology. The cancers of childhood may arise in cells arrested in development prenatally or postnatally.

Certain rare cancers are familial and exhibit anticipation and intensification in the course of transmission. This suggests an hereditary blemish, probably acting to hasten the regressive development of the cells under the stimulation of a harmful environment. Although heredity is discounted

usually as a factor in cancer genesis, the possibility of a congenital predisposition cannot be excluded in some instances. In animals an inherited predisposition appears to be essential in determining the incidence of cancer not only in the animal, but also in the organ involved. In these instances it is considered that resistance to cancer is a dominant character, the absence of which constitutes the liability to develop the disease. The transmission of the character obeys Mendelian laws.

With an inherent ability to vary in response to their surroundings cells commence regressive variations in an unwholesome environment. The effect is determined by the period of growth and the stage of development of the cell. Chronic irritation plays a very important rôle in producing a deleterious environment. The irritant must act on the cells which are to become malignant, and a certain time must elapse before the change occurs. The cancer comes slowly with no evident gap in the passage through chronic inflammation to malignant disease. The habits rather than the appearances of the cells are altered. The length of time of exposure to the irritant with a period for its action rather than the age of the tissues is important in cancer production. One or more exposures may bring about cancerous changes. The cancer may arise some time after the action of the irritant has ceased. Once the malignant process is established, further irritation is not necessary for its continued growth. The irritants may be mechanical, actinic or chemical including the toxins of disease. A long latent period is the rule. In this time slow disturbances of tissue balance impair the nutrition of the cell and bring it to a suitable degree of susceptibility after which the operation of some unknown agent alters the quality of the reaction and the aggressive, lawless characteristics of cancer become manifest. It is notable that there appears to be a specific relationship between the quality of the irritant and the types of cancer produced. In animal experiments the results vary with the different species and varieties of animals used. Perhaps cancer is the result of some unknown function that the cells can exhibit in response to long continued irritation. If this is so, the spontaneous growths are those arising from unrecognized sources of irritation.

Although the cancer cell reverts to a more primitive, less complex type, it may retain some of its specialized functions. It exhibits no gross differences from normal with regard to its oxidative, reductive, hydrolytic or proteolytic processes. Its increased electrical conductivity, capacity and potential are related to its increased permeability for water soluble electrolytes. The raised permeability is connected with the unduly high proportion of lecithin to cholesterol and the increased water content of the malignant cell. A low calcium content with a diminution of fat-splitting enzymes also favours an increase in permeability.

There is an increase in the potassium content of actively growing cancer associated with an alteration in its distribution within the cell. This modification of this slightly radio-active element may be in some way connected with a disturbance of electronic discharge comparable to the degree of malignancy.

The antitryptic action of the blood is increased in cancer. Degenerating cancer cells produce this immunity response. It also occurs in other diseases. There is no alteration in the hydrogen ion concentration of the whole blood. The blood plasma gives no protection against cancer and incipient cancer produces no constant detectable blood alteration. Many attempts have been made to recognize some change in the serum of cancer patients that could be used as a diagnostic aid. Successes have been claimed indicating a subtle reaction of the tissues to cancer growth. Although these researches cover a wide field, the practical applications of the methods have been disappointing. Special attention has been given to Abderhalden's cancer tests. They involve a difficult technique available only in the laboratory. Their importance lies in the fact that they show the cancer cell in a state of dissociation and suggest a specific antigen-antibody reaction to cancer invasion.

It is suggested that the lymphocytes form a temporary defence while the mononuclear cells and fibroblasts are mobilizing. The mononuclear cells are phagocytic. The plasma cells of disputed origin are separated from the cancer by a zone of connective tissue. Endothelial cells appear to be unimportant in these reactions. Polynuclear and eosinophile cells gather with the onset of infection, necrosis and hæmorrhage.

With reference to experiments with transplanted tumours it must be stated that many of the characteristics attributed to cancer cells do not represent primary cellular changes, but are immunity reactions between the graft and its host. Tumour grafts have not thrown any light on the mode of cancer origin. After successful transplantation the graft is a continuance of the growth of the tumour cells of the original neoplasm. The disease is not reproduced *ab initio*.

Tissue culture, although away from the general influence of body reactions, is useful in studying cell metabolism and the interdependence of epiblastic and mesoblastic tissues in attaining full adult structure and function. Our knowledge of the substances which stimulate and inhibit growth, may also be enlarged by these means.

Continued growth of cancer cells in culture requires frequent renewal of the medium, as the cells produce a toxin poisonous to themselves. This toxin does not affect normal tissues. Cancer and embryonic cells grow immediately in culture. This is due to a growth activating substance which they contain. Adult cells need a certain time interval before they commence proliferation. Autolysates of damaged normal tissue and extracts of rapidly growing tumours added to the medium cause adult cells to grow without this delay. Extracts of normal

cells have the power of increasing the rate of growth of malignant tissues.

In vitro cancer cells prove to be more resistant to heat, cold, infection, ultra-violet light and radiation than normal cells.

Recently attention has been drawn to the ability of cells to break up their carbohydrates in the absence of oxygen by ferment action. The *in vitro* attempt to differentiate cancer from normal cell metabolism according to its relative use of these sources of energy, respiratory and fermentative, has demonstrated definite differences. Under ordinary conditions normal tissues make little or no use of glycolysis, while malignant cells have a high glycolytic rate in spite of sufficient respiratory oxygen. Under anaerobic conditions these phenomena are more pronounced; in the presence of excess oxygen glycolysis is lessened in both instances. This difference in energy derivation may be of value as a diagnostic indicator of the degree of malignancy. It has no bearing on the continuance of cancer growth in the host.

Lactic acid is formed by epithelial and muscle cells and plays a part in exciting their functions. Its appearance is temporary and it is resynthesized into the substance from which it is formed. In malignant cells this lactic acid enrichment is more evident and during recovery it does not entirely disappear owing to a failure in the process of resynthesis. Some workers connect this high lactic acid content with the infiltrative properties of cancer.

Little of practical help has followed the clinical study of metastases and recurrences. The diverse modes of dissemination have been mentioned and also the lengthy period that may elapse before recurrence or metastases become obvious. In some instances the removal of the primary lesion appears to withdraw some influence which has been inhibiting the growth of metastases. The spleen is an infrequent site for metastases. In some organs secondary deposits of certain cancers develop more frequently than in others. Lymphatic glands inhibit rather than destroy cancer emboli. Every cancer cell which reaches the lungs does not become a clinical metastasis. The structural type of the cancer is preserved in the secondary deposit with an increase in the degree of anaplasia.

No specific toxin has been recovered from malignant processes that could be held responsible for the poverty of the blood and bodily emaciation which occur in the terminal stages of the disease. It is not possible, however, to deny the existence of some such deleterious agent. The anæmia varies in severity in different patients. It may dominate the clinical picture and bear a close resemblance to pernicious anæmia. In advanced cachexia the blood changes are the result of sepsis, hæmolysis and hæmorrhage.

Irradiation for an unknown reason relieves the cachexia in a small percentage of patients with inoperable growths.

CANCER IMMUNITY.

It has not been possible to determine clinically the reasons for certain individuals developing cancer, while others under apparently identical conditions escape. It is noticed that the more anaplastic the cancer cells are, the less strong is the general resistance. The attempts to influence cancer by stimulating a general immunity have so far been unsuccessful in their application to man. These efforts have been based on the assumption that the cancer cell is a parasite, whereas it is allied to normality in some fundamental way. They fail because the disorder is primarily one of complex biological units with the unruly cancer cell as an effect.

There are wide differences between bacterial infection and cancer invasion, but the general body reactions to bacterial infection have some analogies in the responses to cancer growth. It is likely, however, that the defence mechanism in each instance is quite different.

Experimental evidence indicates that the cancer derives its power for disorderly growth from inherent conditions and not from abnormalities in the person in whom it grows. In animals transplanted and spontaneous tumours produce a resistance to the development of another tumour elsewhere in the host. Removal of the growth decreases this resistance. Irradiated animals offer an increased resistance to tumour grafting.

Experimentally an antiserum has been prepared which produces death of cancer cells *in vitro* and *in vivo* by injection directly into transplanted tumour isolated from the general circulation by constriction of the tumour bearing area. When this has been successful a second tumour not directly injected has been noticed to regress. The reaction is excited by products of the injured tumour cells. Dead cells are ineffective. If the results may be applied to human cancer, it means that any form of treatment will succeed when it produces the correct quantity and quality of damage to the tumour cells that will provoke the favourable immunity reaction. There may be some way of applying radiation to procure damage and slow absorption of cancer material.

d'Herelle considers that immunity depends on an alteration in the state of the intracellular colloids. The reaction is a physico-chemical process and manifests itself in various ways. Fundamentally the stimulation of living matter by a noxious agent brings about inactivation of the excitant by the action of a flocculin produced by the cells. These views explain many of the diverse clinical phenomena of bacterial infection and protein sensitization and may be used to account for the inability of cancer cells to excite the suitable reaction in the tissues of the host without the help of a third agent such as radiation of proper wave length and intensity.

It does not seem that our present amount of knowledge will produce an antibody reaction that

will destroy cancer cells which beyond their abnormal growth tendencies are similar in many ways to their ancestors.

Theories Concerning Cancer Genesis.

The preexperimental stage of cancer research is represented by the theories of Cohnheim (embryonic rests) and Ribbert (displaced epithelium). Although they explain the site and structure of certain cancers, they are not favoured with general approval.

The parasitic theory also lacks wide acceptance. The objections to it include the following: (i) Clinically no neoplastic disease in its incidence and course simulates the recognized infectious diseases, (ii) the wide distribution of cancer with practically no range of transmission, (iii) transplants do not produce a new disease, but keep the original growth alive in a new host and (iv) in the light of known pathological principles a parasitic origin of cancer would not explain why carcinomata and sarcomata remain true to cell type.

Tuberculosis and syphilis appear to increase the susceptibility to cancer. These diseases produce an obliterating lymphangitis which under certain undetermined conditions altering the quality of the reaction, produces cancerous degeneration. A mild pyrexia does not exclude neoplastic disease.

The idea that the Rous sarcoma is due to a filtrable virus acting with a specific chemical substance has met with much opposition. The disease is an unusual one in the animal kingdom and the principles of bird pathology are not clearly understood. Even if the Rous sarcoma was explained satisfactorily by this hypothesis, there is no justification for applying the findings to malignant disease as it occurs spontaneously in man. More recent studies, while failing to confirm the original research, show that the filtrable agent in these chicken sarcomata has the qualities of an enzyme.

Blair Bell claims that malignant disease is a specific growth process in that it is a reversion on the part of starving cells to the nutriment-seeking proclivities of their ancestral type, the chorionic epithelium. Embryonic cells use both sources of energy from carbohydrate decomposition; under anaerobic conditions glycolysis becomes their sole source of energy.

Warburg regards the body as a community of cells with all possible combinations of respiratory and glycolytic rates. A few of the cells of an organ might have the metabolic attributes of cancer cells. Conditions depriving the organ of adequate oxygen, allow such cells to proliferate and become recognized as a new growth.

Pathologists are not agreed that the evidence for these contentions is convincing. The specific choriontropic action of lead is the basis for its reintroduction into cancer therapy with claims as a rational agent.

The fourth theory is that of cell autonomy. The altruism and interdependence of the cells, tissues and organs of the body are known to control normal tissue growth. Cancer is considered to begin when suitable agents act on certain inborn properties of the cell and so upset normal tissue equilibrium that an abnormal strain of anaplastic cells arises rebellious to the body as a whole.

Semisexual cell mitosis has been advanced as an explanation of the origin of cancer. This is a pure example of a deductive hypothesis and calls for a vigorous use of the imagination. No histologist has so far witnessed the conception, birth or nuptials of one of these asexual gametocytes. The natural course of an average cancer in no way resembles the development of an embryo. This suggestion that cancer arises as a semisexual process is rather a poetical than a scientific concept.

In regard to the hypothesis that trauma is a cause of cancer, no success has followed attempts to produce experimental cancer by a single trauma. In animals it has been noted that repeated injury has a direct effect in producing new growth formation in cells susceptible to cancer incidence. Certain bone tumours in man appear to be related to a previous injury.

It is conceivable that the conditions of tissue imbalance suitable for cancer origin may occur during the repair of injured structures. This would apply more particularly to chronically inflamed tissues, benign tumours, maldeveloped organs and displaced cell rests. Adequate proof of normality in the affected part before the accident is necessary with the neoplastic process following in the wake of the traumatic reaction after a reasonable time.

Chronic irritation has also been incriminated. The irritative agents held responsible for cancer development are multiple and non-specific.

In experimental cancer production tar is a favourite substance in use. Small quantities of high distillation products cause the effects. The most satisfactory results are obtained with optimum concentrations. A long latent period of precancerous inflammation follows one or more tar applications before the malignant changes appear.

Mule spinners' cancer may be quoted as a clinical example of cancer due to chronic irritation. The average time of exposure to the action of the irritant mineral oil before the diseases arises is forty years. It may occur thirty years after the occupation has been left.

Some consider that a change in the reaction of the body as a whole is responsible for the manifestation of malignant disease, while others are satisfied that local conditions, such as a continuance of the changes brought about by the irritation or the action of an unknown additional factor, bring about the mutinous growth of the cells. Certain *in vitro* experiments suggest that an inhibition of the factors restraining growth determines the change from the chronic inflammatory reaction to the development of cancer.

Theories Regarding the Mode of Action of Radiation.

Many clinical and experimental observations point to the complex interdependence of the cells, tissues and organs of the body in the production of tumour regression. Therapeutic radiation seems to secure part of its results by helping the body to increase the defence powers that it sets in motion itself against the neoplastic onslaught. The epithelial and connective tissues form biological units with a mechanism for the preservation of normality and its restoration after any disturbance (neoplastic, infective, traumatic). If equilibrium is merely disturbed, stability can be regained; if its integrity is lost, readjustment is impossible. Recovery of the tissues after irradiation is more readily explained by such a power of accommodation than by assuming that a return to normal involves the reconstruction of disintegrated protoplasmic systems.

The reactions are not specific, but irradiation is a specific method of treatment in so much as the effects are not obtained by other means. The result is neither a cauterization nor a pure effect of a non-specific immunization. The effect is considered to be directly on the nucleus of the cancer cell. The chromatin is the radioceptive material. The vascular connective tissue and lymphocytic reactions are identical with those described in general pathology following any injury to the cells and tissues. In the ionization of air only one atom in many millions is affected by the wave lengths employed for therapeutic purposes. If tissue effects depend on similar ionization, a theoretical objection can be raised against the possibility of producing a direct cell effect on all the cells by radiation as applied at present.

A further view is that radiation treatment produces tumour regression by provoking a general body reaction inimical to continued cancer growth.

It is also suggested that the radiation energy is converted into heat at the sites of absorption of the quanta of radiation. These heat points affecting the colloidal structure of protoplasm, initiate the changes responsible for the biological effects.

The fourth explanation is that the absorption of the radiation quanta raises the potential energy of the chemical compounds of the cell protoplasm. The biological effect results from sensitization. The result is similar to that produced by the photochemical action of the rays. Cell constituents with raised potential energy enter into abnormal chemical combinations (latent period) and vital processes being grossly deranged, cell disintegration ensues. The biological effect also results from abnormal catalysis, from abnormal electromagnetic fields and from abnormal electrolysis.

These purely physical explanations of radiation biological effects are not entirely satisfactory, as clinical studies indicate that the tissues bring into action a vital accommodating and compensating mechanism when exposed to the rays.

In the next place alterations in hydrogen ion concentration, osmotic pressure variations, changes in cell permeability, alterations in the dispersion phases and the electrical charges on the colloidal particles with changes in the plasma albumin are notable features after irradiation. It is concluded, however, that primary changes in these chemical and physical systems cannot be held to explain radiation effects. Irradiation removes from the tissues their normal lipoid content. As cancer cells cannot survive without their lipoids it is suggested that this result of exposure to radiation is responsible for cancer dissolution.

There is little support for the idea that cholin liberated from lecithin after irradiation produces the biological effects.

The disintegration of the cancer cell is not due to the reduction in its glycolytic power by irradiation. Radiation has no appreciable effect on the energy exchanges of the tissues and inhibition of growth after treatment is not connected with the energy yielding reactions of the cells.

It has further been maintained that irradiation destroys toxic bodies produced by the tumour and so permits repair to proceed.

In the last place it has been claimed that effective therapy gains the majority of its effects by closing the blood supply of the tumour.

Prospect.

The ultimate analysis of the problems under consideration discloses the paucity of our knowledge. The information concerning normal cell growth is imperfect. We are unable to point to the deviation from normal which results in cancer. The factors determining an occasional spontaneous cure cannot be stated. Our information concerning the nature, biological absorption and the mode of action of radiation is equally scanty. The lack of a universal standard of X ray dosage and the wide differences in output of different X ray installations and of the same installation under varying physical conditions are responsible for much misunderstanding, even among radiologists themselves.

It is noteworthy that the radiosensitive neoplasms respond equally well to wide ranges of both quality and quantity of radiation. Excellent results follow inadequate dosage at times. In these circumstances the question of massive or fractional doses does not appear to have any material bearing on the initiation of the processes which result in the regression of the disease. Massive doses are unsuitable when prophylaxis is the aim of treatment.

At present we are unable to say if our results are due to the action of a particular wave length of radiation or whether a certain spectrum is necessary to effect the desired biological reaction. Research has not indicated definitely the period of cell or tumour growth that is most suitable in which to deliver the radiation attack. When we consider that a heterogeneous primary beam with its secondary undulatory and corpuscular rays

affects countless electronic systems in atoms and molecules in arrangements peculiar to the colloidal nature of protoplasm, we realize the well nigh impossible task of predicting the effect that will predominate and produce the ultimate result.

Much experimental work has been done trying to establish a differential absorption and action for the various wave lengths of radiation in biological reactions. Striking results in producing tissue alterations in animals and chick embryos have been procured by using monochromatic beams in these researches. It is noticed that reactions follow doses considerably less than those necessary when heterogeneous beams are employed. It is suggested that certain beams of radiation nullify one another in securing biological effects. There are certain objections to these studies which make one hesitate before accepting the conclusion that the differential action of monochromatic beams of radiation has been proved by them.

The chemistry of the chorio-allantoic membrane and the skin of the tadpole (the tissues used in the experiments) is not reviewed by the investigators. The presence of minerals not usually found in living tissues might account for their sensitivity to certain wave lengths of radiation.

The X ray dose delivered to the surface of the irradiated tissue is accurately given without any estimate of the distribution of the radiation energy or of the amount absorbed in the tissues. Previously it was held that the absorption of similar amounts of radiations irrespective of wave length produced similar biological responses. The effect was considered to be due to some action of the β rays liberated by the absorption of the incident beam. To displace this suggestion it is essential to show that even when equal intensities of the various monochromatic beams are absorbed by the tissues, the differential action is still demonstrable.

Exception can also be taken to the methods of measuring the incident radiation in some of these experiments. Theoretically it is probable that the ionization chamber measurements are misleading when they are used to compare the intensities of monochromatic beams. The human tissues and air have similar absorption curves for the heterogeneous beams used in radiotherapy. The researches under consideration assumed that the animal tissues employed and air exhibit similar properties when monochromatic beams are used.

The distribution of different wave lengths varies even in thin sections of tissues. The basis for a satisfactory comparison of the effects of beams of homogeneous rays of different wave lengths depends on the absorption of the rays in similar volumes of the irradiated tissues.

The total effect in each instance represents a summation of many individual effects, lethal, inhibitive and stimulative. In the circumstances it is not possible as yet to be definite about the chemical or physical effect primarily involved in favourable radiotherapy.

Clinically the quality of the skin reaction after soft radiation differs from that following hard radiation. This supports the idea of a differential action of radiation of different wave lengths, a conclusion which is also suggested from theoretical premisses based on a review of the structure of matter and the absorption of radiation. The differences in biological reactions following the use of radiation from widely different parts of the spectrum are due to the different physical properties of the rays. The differences which occur when rays close together in the spectrum are used, may be due to different distributions of the radiation energy in the tissues as a result of absorption and distance.

It is quite probable that the next advance in radiotherapeutic technique will be in the direction of refining the beam of incident rays either by an alteration in the manner of their production or in an improvement in our methods of filtration.

Clinical studies demand that the latent period following irradiation, the variability in response of different and apparently identical tumours, the establishment of radio-resistance after repeated exposures and the disappearance of lesions not directly exposed must all be explained by any theory dealing with the biological action of radiation.

It is difficult to correlate these observations with the known properties of radiation. Although our present methods of examination reveal no appreciable changes in the tissues immediately after exposure there can be no doubt that the absorbed rays have altered protoplasmic structure. The latent period varies in length considerably and suggests the production of a change of a photochemical nature which requires subsequent development before it becomes discernible. The circulation of the blood in the part after irradiation may secure this effect. The occlusion of the blood vessels by previous exposures would explain the failure of repeated treatments. The effect on tumour growth at a distance, however, is not covered by such a hypothesis. These distant effects suggest the elaboration of some chemical substance deleterious to cancer proliferation. It could come directly from the irradiated area or result from a reciprocal action of other organs, such as the endocrine glands with their obscure but none the less important control of metabolism and growth.

The histological characters of the irradiated cell indicate that the treatment produces its dissolution. They do not help *per se* in deciding whether the changes are due to direct effects on the cell or follow disturbances in some other part of the biological unit or represent a reaction to a systemic alteration.

The value of animal experiments in studying the reception and utilization of radiation cannot be finally determined until fuller knowledge of animal physiology and pathology is available. It is possible that a great deal will be learned from comparative pathology.

The constitutional aspect of disease has a place in the clinical discussions on cancer. The constitution has been defined as the sum of the morphological, physiological, immunological and psychological characters with which an individual is born. Heredity and certain unknown agents are responsible for each combination. There are wide variations in normal individuals. It is at least conceivable that certain variations predispose the bearer to a condition of disease when he reacts to the external causes of disease. It can be seen how recognition of the constitutions prone to disease would result in preventive and early therapeutic measures being formulated. The clinician notes the varying resistance of different individuals to disease and it is within his scope to help an advance in the knowledge of the constitutional bias to malignant disease, if it exists. The predilection of rodent ulceration for a certain type of skin (hereditary inability to pigment) under chronic actinic irritation is a ready example.

Clinically irradiation causes tumour regression and so is a potential control for cancer growth. Every radiologist knows the thrill of the odd dramatic result, even apparent cure. The fundamental factors underlying the response are not known and the beneficial result cannot be repeated.

The early hopes that the alteration of technique, called deep therapy, would displace radium as a therapeutic agent and be an advance in cancer therapy have not been realized. It has certain uses in a limited sphere of applicability, particularly as a palliative, but even then benefit is not the invariable result.

Clinical results do not justify the universal use of deep therapy alone in inoperable cancer with the object and promise of cure. This does not apply to its employment as an adjuvant for operable tumours or as a preoperative or postoperative measure.

If it is considered that radiotherapy should aim to get its effects by a direct cellular action with a minimum of necrosis in the tumour mass, the method of using deep therapy will have to be altered so that the principles laid down by Dominici and Regaud for radium therapy can be followed.

In this regard the laboratory will be of help in determining (i) if there is a wave length or combination of wave lengths capable of selecting some resonator in and peculiar to cancer cells and so affecting them in some phase of their life cycle that further growth is rendered impossible, (ii) the most sensitive period or periods in cell life in which irradiation should be repeated with the object of producing tumour regression, (iii) the value of adjuvants directed towards increasing the radiosensitivity of tumours, (iv) more intimate information of the colloidal chemistry of cancer cells which might reveal the mechanism of adsorption governing the selection by the cell of poisons which would destroy its growth.

The problems are biological rather than physical. Mathematical formulæ and rule of thumb procedures must retreat before clinical experience in matters where cancer biology is imperfectly understood and each patient presents a problem which requires an individual solution.

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Reports of Cases.

A FOREIGN BODY IN THE LEFT BRONCHUS.

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Clinical History.

A BOY, aged ten and a half years, who had had his tonsils and adenoids removed under general anæsthesia outside the hospital on March 24, 1930, was admitted to the Adelaide Children's Hospital on March 28 with the diagnosis of a tooth in a bronchus. On examination his general condition was good, he was in no distress, but had periods of frequent small coughs and of quiet breathing. The left side of the chest was expanded to about that of full inspiration of the right side and hardly moved on breathing, the percussion note was dull over the left upper lobe and resonant over the lower. Examination of the mouth showed the absence of the second right lower deciduous molar tooth, the gum having a few small lacerations there. The radiologist's report was: "A foreign body is present at the division of the left bronchus, opacity of the left upper lobe suggesting a partial collapse." There would appear to have been a blocking of the upper lobe branch bronchus and a valve action in the main stem of the bronchus, allowing air to get in but not out of the lower lobe. The shadow was the shape of a crown of a molar tooth.

At 9 a.m. on March 29 he was given a hypodermic injection of morphine 8·0 milligrammes (one-eighth of a grain) and atropine 0·65 milligramme (one-hundredth of a grain). The crown of the corresponding lower left molar which was loosely attached to the gum, was removed. At 10.15 a.m. bronchoscopy was done by Dr. E. A. Matison without anæsthesia; he used a seven millimetre bronchoscope of the Chevalier Jackson type. The tooth was seen in the left bronchus, gripped with forceps, but slipped out and could not be seen again. On April 1, after preliminary morphine and atropine administration and without anæsthesia, a six millimetre bronchoscope was passed into the opening of the upper lobe branch of the left bronchus, the tooth was seen, gripped by forceps and withdrawn. It proved to be the crown of a deciduous second lower molar, exactly similar to the one removed from the other side of the mouth. It measured 10·0 millimetres long, 9·0 millimetres wide and 6·5 millimetres high.

Comment.

The case is interesting, first, because the tooth found its way into the left bronchus instead of the right which is more in a direct line with the trachea and more accessible; for the same reason it was harder to extract from that position. Secondly, it illustrates with what respect we should approach a child's mouth when he is under general anæsthesia, especially between the ages of six and twelve years, when the deciduous teeth are being shed. This boy had good undecayed temporary teeth which were being cast off by the normal physiological process of absorption of the roots as the permanent teeth erupted. There comes a stage when but a slight movement, as in mastication, dislodges the crown; if at this period in a child under general anæsthesia a gag or other instrument is pushed into the mouth, there is immediately the potential danger of a foreign body being introduced into the air passages. Children for enucleation of tonsils at the Adelaide Children's Hospital with bad teeth are sent to the Dental Hospital for treatment; nevertheless, it is my custom to inspect each child's mouth and when they are anæsthetized, to remove any loose crowns of temporary teeth, even though they be undecayed.

Acknowledgement.

I am indebted to Dr. E. A. Matison for permission to report this case.

Reviews.

THE PROBLEM OF DIAGNOSIS.

IT is often said that diagnosis is the basis of medicine and certainly enough books are written on the subject to justify the statement.

From the small handbook of the medical student to the three-volume reference work for the consultant is a wide range; but mostly they fall into an intermediate type, a volume of moderate size, with many pages, many pictures and often with special chapters written by specialists. Such volumes are especially common among the products of American publishing houses and a good example is that of "Diagnostic Methods in Internal Medicine," by Dr. S. A. Loewenberg.[1]

This is a book of nearly a thousand pages of thin paper; so that the book is not unduly heavy and is easily handled. The thinness of the paper rather spoils the illustrations, which, however, is of little importance as these are the weak point of an otherwise excellent book. Some indeed are bad representatives of their supposed subject; others are so badly reproduced as to afford little information.

The letterpress is, however, of quite a different quality. The system is followed of describing first the method of examining an organ or system, then the diseases to which it is liable. The methods given are the plain and simple ones of established practice, but well described, so that a student reading the book could easily apply them.

There is an article on the surface anatomy of each system; they are generally excellent, but that on the abdomen is sadly out of date. Surely radiology has taught us that the average stomach no longer lies coyly tucked up under costal margin and liver; the fish-hook type, so common on the screen, is barely mentioned.

In general the account of disease is clear and concise, the one failure being that of the bones, which is sketchy in the extreme. Perhaps the best is the account of the nervous system, contributed by Dr. Milton K. Meyers; not the least of its excellencies is a long list of syndromes, many indeed out of the way, but many of daily occurrence.

Another contributed chapter—a poor one—is that on radiography by Dr. Leon Solis Cohn. It is doubtful what place should be given to a special subject like radiography in a work on general diagnosis, but at least the main discussion should be the applications of the method in general diagnosis and the illustrations should be chosen to bring out these points. Here the letterpress is dull and the plates reproduced seem very poorly to show the conditions under discussion. Encephalography and "Lipiodol" are not even mentioned.

A contrast is the chapter on the electrocardiograph. Here there is a short discussion of the principles of the instrument, its method of use, the conditions in which it is of value, and finally a description of tracings obtained in different conditions.

A chapter on laboratory methods is comprehensive, but details of special methods are wisely left to special text books.

The last chapter is devoted to methods of examination for life insurance, industrial examinations (including malingering) and periodical medical examinations. Here it is to be noticed that the author prefers examination by one competent physician, rather than the "team" methods at present coming into favour.

An excellent feature of the book as an aid to diagnosis is afforded by the number of tables scattered through it. The author has frankly borrowed many of these and borrowed well; special reference may be made to the tables (from Boothby) showing the basal metabolic rates for both endocrine disorders and many non-endocrine disorders.

Apart from the defects which have been noticed, the book is a sound and useful production, likely to be of very great service to the busy practitioner, house physician or senior student.

[1] "Diagnostic Methods and Interpretations in Internal Medicine," by Samuel A. Loewenberg, M.D., F.A.C.P.; 1929. Philadelphia: F. A. Davis Company. Royal 8vo., pp. 1055, with illustrations. Price: $10.00 net.

The Medical Journal of Australia

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Professional Advertising.

ACCORDING to the "Handbook for Recently Qualified Medical Practitioners," issued by the British Medical Association, the word advertising in relation to the medical profession must be taken in its broadest sense. "It includes all those methods by which a practitioner is made known to the public, either by himself or by others without his objection, in a manner which can fairly be regarded as having for its purpose the obtaining of patients or the promotion in other ways of the practitioner's individual professional advantage." The General Medical Council of Great Britain inflicts the most severe penalties on offenders. Any medical practitioner found guilty "of advertising, whether directly or indirectly, for the purpose of obtaining patients or promoting his own professional advantage; or for any such purpose, of procuring or sanctioning or acquiescing in the publication of notices commending or directing attention to the practitioner's professional skill, knowledge, services or qualifications, or depreciating those of others; or of being associated with or employed by those who procure or sanction such advertising or publication," is liable to have his name erased from the Medical Register. The position in Great Britain is thus perfectly clear. The difference between direct and indirect or oblique methods of advertising is recognized. The former may be either prohibited entirely or controlled by definite regulation. The latter is insidious and, being a weapon forged by craft and subtlety, is difficult to trace to its source. The question of indirect advertising has been discussed in these pages on more than one occasion, that of direct advertising but seldom.

At a recent meeting called specially for the purpose, the members of the New South Wales Branch of the British Medical Association gave careful consideration to a proposed alteration of the rules of the Branch in regard to the class of advertisement permitted in the daily press. As already reported in this journal, Dr. C. B. Blackburn introduced the subject on behalf of the Council. The motion moved by him and carried by the meeting, will have the effect of doing away with all advertisement of resumption of practice by members of the New South Wales Branch. The discussion was full of interest and it was quite evident that most of those present were disinclined to allow any form of advertisement. A recommendation was sent to the Council that steps should be taken to prohibit advertisement in any form.

The action of the New South Wales Branch makes it appropriate that this subject should be discussed. It is recognized on all hands that it should not be left to practitioners to advertise according to their individual tastes, their goings and comings and their changes of address, but that, if direct advertising is to be allowed, it should be subject to regulations binding equally on all practitioners. There may be some who think that the fact that they have started in practice is a matter of public importance and that it is a public duty to advertise it, even if the publicity so given might incidentally bring them patients. It is the same with changes of address. Public advertisement of the latter is superfluous to all newspaper readers, for the comparatively few people directly interested could without difficulty be directly notified. Advertisement of the fact that a practitioner will be away from his practice until a certain date is sometimes seen. The motive of this is not always clear. From whatever aspect the whole question is considered, it cannot be concluded that public advertisement has any other object than the personal advantage of the practitioner concerned. In matters of this kind it is useful to pay attention to the customs adopted in other parts of the world. The position in Great Britain has been made clear. In South Africa it is held that "medical practitioners may not advertise in the lay press in any professional respect whatsoever." Nothing could be more definite than this. According to the principles of medical ethics of the American Medical Association, adopted by the House of Delegates in 1912

and revised in 1927, "it is unprofessional . . . to employ any methods to gain the attention of the public for the purpose of obtaining patients." It is high time that Australia fell into line. The standard adopted in the Commonwealth should not be lower than that existing in other parts of the world. The more a medical practitioner relies on his professional ability and his clinical results to proclaim his skill, the stronger will be his position; and there is no doubt that the elimination of all forms of direct advertisement would strengthen the hands of Branch Councils in dealing with the subtle and mischievous obliquity of indirect advertisement.

Current Comment.

LEPROSY.

THROUGH the ages leprosy has been regarded as a foul and loathsome disease and people have shunned the leper's "unclean" touch. In ancient and mediaeval times this led to the ostracism of lepers and to the cruel imposition of much unnecessary hardship, not only on lepers themselves, but probably also on sufferers from any of a vast number of skin diseases, all of which, through faulty diagnosis, were classed as leprosy and "unclean." Segregation of lepers has been adopted in ancient and modern times to stem the spread of leprosy, but hitherto little thought appears to have been given to the relative infectivity of the individual and indiscriminate segregation of patients in all stages, types and phases of the disease has been the rule.

In a paper read before the Calcutta Branch of the British Medical Association recently, E. Muir discussed the problem in the light of modern knowledge and investigation.[1] He states that while there can be no doubt concerning the contagious nature of leprosy, there are several factors other than mere contact which influence its spread. These are closeness of contact, length of contact, infectiousness of the leper and the general resistance of the person in contact.

Leprosy can generally be diagnosed clinically long before Hansen's bacillus is demonstrable in the tissues or secretions. This was shown by G. H. Taylor in New South Wales in 1926. If careful examination of an anæsthetic skin lesion fails to reveal the presence of bacilli, they must be so scanty that the danger of their escape through the overlying epithelium to a suitable soil on which to multiply, must be negligible. Even if a few bacilli can be found in such a lesion, the risk of infection is practically nil. Muir's experience leads him to recommend as a safe rule that only those patients should be isolated in whom bacteriological examination reveals the presence of bacilli. The lepers most dangerous to the community are those whose nasal secretions contain bacilli or who suffer from ulcerating skin nodules. Almost every patient with an ulcerating skin lesion has also a definite lesion of the nasal mucosa, hence Muir believes that the elimination of nasal infection would mean the elimination of practically all infection. To leave a considerable margin of safety, however, he advises that all patients in whose lesions leprosy bacilli can be found, should be removed from their employment, on leave if possible, until bacteriological examination reveals no bacilli. Frequently the disease, if detected early, may be arrested before the expiration of the patient's leave.

Muir's views form an interesting comparison with those of Cook as set out in the Commonwealth Health Department's "Service Publication," Number 38, 1927, and those of Molesworth as published in THE MEDICAL JOURNAL OF AUSTRALIA of September 18, 1926. Cook is a staunch supporter of the lazaret system. To meet Australian conditions he recommends the segregation in leprosaria of all aboriginal lepers whether bacilli are discoverable or not, but favours home isolation for whites when no bacilli can be found in their lesions. Molesworth, on the other hand, arguing that the reduction in the incidence of leprosy in various countries has been due to an elimination of susceptible people rather than to the practice of segregation, expresses the opinion that such practice should be discarded and appeals for a review in a "strong humanitarian spirit" of prevailing methods in handling lepers. He stresses the mental suffering associated with imprisonment for an indefinite period in a leprosarium.

Until recently leprosy was a hopeless and incurable disease and in the past perhaps the main object of isolation was to relieve the community of the presence of sufferers from a horrible malady. Therapeutic methods have advanced to such an extent within late years, however, that modern expert opinion, though still favouring segregation as perhaps the most important procedure, tends more and more to recognize the great value as a prophylactic measure of the early institution of treatment and the encouragement of patients in early stages of the disease to present themselves for medical attention. In the absence of any threat of isolation, concealment (said by Cook to be apparently rare in Australia) becomes far less prevalent and as a consequence greater numbers of patients receive treatment. Surely, it is argued, the treatment and cure of many early sufferers are of greater value to the community than the late removal of some lesser number of advanced and highly infectious patients from whom already perhaps numerous others have contracted the disease. A strong advocate of early treatment in clinics and the non-reliance on compulsory segrega-

[1] *The Indian Medical Gazette*, November, 1929.

tion as the main prophylactic measure is no less an authority than Sir Leonard Rogers. In a paper in *The Practitioner* of April, 1928, he points out that the effective treatment of the great majority of lepers in the early non-infective stage would cut off the supply of new sources of infection and, if continued for one or two decades, would result in a very great reduction in the disease incidence, for the infectious stage of anæsthetic and mixed types lasts about ten years and the advanced nodular type usually kills in about the same length of time.

Perhaps the wisest and most humane system for control of the leprosy problem would be one providing for cumpulsory segregation of all lepers with *Bacillus leprœ* in their nasal secretions and compulsory treatment in clinics without isolation of all others. Concealment of disease does not appear to be common in Australia, but in the Mandated Territory of New Guinea, in parts of which leprosy is prevalent, the native's superstitious dread of hospital and isolation leads to frequent concealment. The institution of some such system as suggested above, by removing the fear of segregation, would probably result in the availability of far greater numbers for treatment and would thus prove a big factor in the eventual solution of the leprosy problem.

THE DIAGNOSIS OF PANCREATIC DISEASE.

THE diagnosis of pancreatic disease is notoriously difficult. The frequency with which diagnosis is first made in the *post mortem* room, testifies to this. Many tests have been used in attempts to reveal pancreatic disorders. Gross and Guleke in 1924 described fourteen tests of pancreatic function. Most of them have proved unsatisfactory. In considering pancreatic disease it is necessary to remember that either the islands of Langerhans or the acini and ducts or the whole glandular structure may be affected. Robert Elman, Norman Arneson and Evarts A. Graham have recently made a study of the value of blood amylase estimations in the diagnosis of acinar pancreatic disease.[1] The blood amylase has been used by other observers as an index of the pancreatic condition. Wohlgemuth in 1908 described a method which depends on the complete hydrolysis of starch as revealed by the disappearance of the blue colour which it produces with iodine. Another method depends on the formation of sugar which is measured quantitatively by copper reduction. Both these methods have produced results which are widely divergent. Elman, Arneson and Graham tried both methods and found them unsatisfactory. They have finally adopted a method which they claim has not been used before for this purpose. It is based on the rate of diminution of the viscosity of a starch solution and by this method it is possible to follow quantitatively and continuously the course of the diastatic reaction, in other words the breaking down of starch to dextrose, for each step of the reaction involves the hydrolysis of larger to smaller molecules and hence a reduction of viscosity. Elman, Arneson and Graham point out that there are two immediate advantages: every step of the diastatic reaction becomes measurable at the same time and time can be used as a measure of enzyme concentration. An arbitrary amount of change was selected, 20% reduction of viscosity, and the amount of amylase then became a function of the time required to effect this change. For the use of the method it is necessary to have viscosimeters and a suspension of starch of constant composition. It is impossible to describe in detail the setting up of the apparatus and the method of its use.

In the first place the findings of the estimation of blood amylase of twenty-five so-called normal controls are recorded. The only criterion of normality was that there was in no instance any suggestion of pancreatic disease. Amongst these persons were two diabetics who gave no indication of acinar pancreatic disease. The blood amylase was in all cases within what were designated normal limits—4·3 to 6·8 units. One unit was taken as the amount of enzyme in one cubic centimetre of plasma which would reduce the viscosity 20% in one hour. Data are given from thirty-four patients who were either subjected to operation (inspection and palpation of the pancreas being possible) or who came to autopsy. In eleven instances the pancreas was normal and the blood amylase in these was within the normal limits previously mentioned. In twenty-one of the remaining twenty-three deviations from the normal values were found. In most instances there was a definite increase in the blood amylase, the values varying from 7·8 to 150 units; in some there was a decrease, the values ranging from 0·5 to 3·1 units. Chronic pancreatitis was found in ten instances, carcinoma of the pancreas in seven, acute pancreatitis in two, pancreatic cyst in two, injury to the pancreas in one and pressure on the pancreas in one. The explanations given for the increased and the decreased values of amylase are interesting. Decrease is attributed to more or less complete atrophy of the acinar cells. If amylase is derived from these cells, atrophy would obviously cause a decrease. Increase in amylase is regarded as being due to obstruction to the ducts. Since obstruction may lead to atrophy, there might come a time when a normal value of amylase would occur in a progressive pancreatic lesion.

Elman, Arneson and Graham admit that palpation of the pancreas is not a very satisfactory way of determining the condition of a pancreas and they lay stress on the difficulty of securing a standard solution of starch. It must be remembered that opinion is not unanimous in regard to the site of formation of amylase, whether it be in pancreas or liver. At the same time it must be admitted that a correlation has been shown by these observers to exist between concentration of blood amylase and pancreatic disease. Their observations, moreover, tend to support the view that amylase arises in the pancreas.

[1] *Archives of Surgery*, December, 1929.

Abstracts from Current Medical Literature.

UROLOGY.

Ureterocele.

V. J. O'CONNOR AND A. B. JOHNSON (*Journal of Urology*, January, 1930) make a study of nineteen cases of true ureterocele observed by themselves. They say that the condition is far more common than the reported number of cases would suggest. The condition is due to pressure resulting from a stenosed ureteric orifice and the stenosis is probably always of congenital origin. True ureterocele should be carefully distinguished from mere prolapsus of the ureteric mucosa. The authors made careful ureterographic studies in fifteen of their cases. They found that the size of the intravesical cyst was no index of the degree of dilatation of the ureter. Another feature of great interest was that, while in most instances the lower part of the ureter was widely dilated, the outline of the renal pelvis and calyces was normal. In their series there was found no evidence to support the theory that ureterocele arises from obstruction in the ureter above the level of the bladder wall. The best treatment is as a rule cystoscopic coagulation of the protruding cyst. The cyst may also be coagulated by suprapubic approach and in unusual circumstances, for instance when the sac contains calculi, suprapubic incision is preferable. The authors did not discover any evidence of atony of the ureter.

Cancer of the Prostate.

R. DOSSOT (*Journal of Urology*, February, 1930) considers that simple prostatic adenoma plays an important part in the pathogenesis of numerous cancers of the prostate. In 11·6% of cases of benign adenoma of the prostate malignant transformation is definitely known to occur. In the urethro-prostatic type of cancer of the prostate, the carcinoma develops from glands of the mucosa of the prostate urethra; in true cancer of the prostate the malignant process develops from the prostate itself. Adenomata coexist with carcinoma in nearly 60% of all carcinoma cases in this region. It is unfortunate that invasion of lymphatic glands and of neighbouring organs occurs very early and indeed before it can be recognized clinically the malignant process has often spread to secondary classes of glands in the pelvis and abdomen. In regard to treatment, prostatectomy, radium therapy and deep X ray therapy have given only mediocre results and it is exceptional to find any patient in whom suffering has been alleviated for more than three years. True cures can be obtained in patients only when enucleation has followed upon a diagnosis of adenoma and when subsequent histological examination reveals the existence of cancer. When cancer is definitely diagnosed by clinical means, it is prudent to limit treatment of dilatation of the urethra or else permanent cystostomy.

Uretero-pyeloplasty.

R. H. HERBST AND H. J. POLKEY (*Journal of Urology*, January, 1930) make a critical study of the classical operation for the relief of stenosis at the uretero-pelvic junction. This operation which was based on the Heineke-Mikulicz pyloroplasty, was introduced by Fenger in 1894 and consists of a longitudinal incision through the stenosed region, the incision then being sutured transversely. Fenger's patient and other patients were reported as completely cured, because the pain had disappeared and the kidney was not enlarged on palpation. Modern study by pyelograms and functional tests have shown that in nearly all such patients the affected kidney becomes progressively atrophied on account of the continued hydronephrotic process, as this classic form of plastic operation normally fails to relieve the obstruction. The authors performed experimental work on thirty dogs, producing hydronephrosis and later on performing Fenger's operation. Failure was found to be due to mechanical buckling of the ureter at the site of operation and to increased scar tissue production. The authors believe that some form of anastomosis between the pelvis and ureter will give better results than the plastic operation.

Radiolucent Vesical Calculi.

J. MOMBAERTS (*Journal d'Urologie Médicale et Chirurgicale*, August, 1929) has studied all the physical agencies which render a number of calculi invisible by radiological methods while they are in the bladder, when the same calculi are perfectly radio-opaque when photographed outside the body. Principally it has been found that movement of the calculi and the influence of surrounding fluids are important factors in decreasing radio-opacity. In order to secure the best results in taking radiographic pictures of vesical calculi, the following rules should be observed: (i) Empty the intestine wall, for gas and fæcal matter are very troublesome. (ii) Eliminate intestinal peristalsis with opium given some hours before the radiogram is taken. (iii) Avoid any enema which may leave fluid in the bowel. (iv) Immobilize the patient completely during the exposure and compress the vesical region. (v) Empty the bladder before the exposure.

Technique in Pneumopyelography.

E. CHAUVIN AND R. EMPÉRAIRE (*Journal d'Urologie Médicale et Chirurgicale*, June, 1929) concern themselves with efforts to improve the technique of the recently reintroduced method of pneumopyelography. It is difficult with this method, where air is injected, to secure an adequate delineation of the renal calyces, even though the outline of the pelvis shows up satisfactorily. The important point is to maintain an almost constant intrarenal pressure with the injected air while the radiogram is being taken. The normally employed 20 cubic centimetre glass syringe is not sufficiently large for this purpose, so the authors advise a 100 cubic centimetre metal syringe which holds its contents tightly, but at the same time works freely. With the syringe is connected a Claude manometer which registers the air pressure in centimetres of water. The air is injected slowly until the manometer registers 60 to 80 centimetres of water. The radiographer is now asked to make the exposure and while this lasts, the pressure is maintained at a constant level. This continual slow injection is necessary since the air so easily escapes down the ureter beside the catheter. The authors have found a semilateral position, with the patient resting on the healthy side, the best for securing a clean outline of the calyces. The object of this position is to place the ureteric outlet of the renal pelvis in the most dependent position, so that when air is injected into a calyx where a little urine is lying, the urine will be the more easily pushed out of the cavity by the increasing gaseous pressure and not remain *in situ* to blur the outline of the calyx in the radiogram.

Intravesical Partial Resection of the Bladder.

H. H. YOUNG (*Journal of Urology*, February, 1930) has developed a new form of operation for the removal of the vesical neoplasms by intravesical approach. The method is applicable particularly to tumours of the posterior wall and floor. The cutting is done from within the bladder. The new technique involves the so-called "mobilization" of the bladder by means of division of the main vascular trunks running to the upper lateral and posterior portions of the bladder. By the intravesical method unnecessary vascular disturbance is avoided and there is less anatomical and physiological disturbance to the functioning of the organ. The dangers of infection are greatly reduced, since the ischæmic, isolated and traumatized bladder may easily be the prey of serious deep-seated inflammatory processes which may lead to pelvic infections, thrombophlebitis and pulmonary embolism. In tumours of the posterior wall and particularly those low down an intraperitoneal approach is commonly used. The new method, however, gives an easier access to the deeper regions and the whole bladder wall together with the peritoneal coat is easily removed by the technique described by the author. Should the malignant process involve the lower end of a ureter or the seminal vesicles, these parts are easily removed by this method. The peritoneum and the bladder are sutured separately from the bladder side. The bladder is drained suprapubically with a de Pezzer drain.

Urinary Incontinence.

F. VON MIKULICZ-RADECKI (*Münchener Medizinische Wochenschrift*, January 24, 1930) discusses the various

procedures adopted to control urinary incontinence in the female. In all uncomplicated incontinence when cystocele exists with a varying degree of overstretching of the muscular layers, he recommends a thorough vaginal plastic operation. Other measures are required in complicated incontinence, especially when definite fistula formation has occurred. If a muscle-splitting reconstruction be unsuccessful, he advises the use of a flap from the *pyramidalis* muscle. In patients past the menopause with moderate degrees of prolapse, the interposition operation of Schauta-Wertheim can be employed. This is also useful in severe fistula when other plastic methods have failed. Each patient's condition should be carefully surveyed before deciding on a particular operation. If failure occurs, subsequent operations will be rendered much more difficult and what was possibly a simple condition at first, may become inoperable.

DERMATOLOGY.

The Skin in Diabetic Patients.

A. M. GREENWOOD AND E. M. ROCKWOOD (*Archives of Dermatology and Syphilology*, January, 1930) have examined the interdigital spaces of the feet of a hundred diabetic patients with a view to ascertaining the prevalence of the bacterial and fungus flora. Scales and pieces of skin were examined microscopically and cultured on Sabouraud's medium; fifteen specimens were taken from each patient. Of the hundred patients examined 70% gave positive clinical evidence of fungus and of these 71% gave positive results on microscopical examination. Yeasts and saprophytic fungi were rare, but 100% showed the presence of staphylococci. It was not possible to correlate hyperglycæmia with the local infections. The authors believe that all thickened and opaque nails on the feet will manifest fungus infection. Instruction in the care of the feet resulted in a 50% improvement.

Cooly Itch.

HUGH W. ACTON AND C. MCGUIRE (*Indian Medical Gazette*, May, 1929) discuss the ætiology, symptomatology and treatment of cooly itch. The term "cooly itch" has been loosely applied to pustular dermatitis of various types, even to scabies. Castellani applied the term to an extremely irritative dermatitis commonly seen in the lower classes; he suggests as a possible causation some insect with a similar rôle to that of *Tyroglyphus longior* in copra itch. Cooly itch is an intractable, intensely irritating dermatitis characterized by inflammation and thickening in the region of the hair follicles. Inflammation frequently proceeds to suppuration with the formation of pustules which are surrounded by a reddish-purple zone of induration. The disease attacks the legs and thighs and sometimes the beard area in the male and in women the outer surface of the forearm. The scalp is not as a rule affected. This distribution is largely influenced by the rubbing of the clothing. The disease is caused by a variety of *Trichophyton violaceum*, named by the authors "indicum." The fungus grows well at room temperature on Sabouraud's maltose agar, forming a violet coloured colony exhibiting aerial hyphæ and thick, dense roots. It is, however, difficult to obtain pure cultures. Treatment consists in painting the affected area three times daily with a 5% solution of gentian violet. Pustules are opened and treated with a drop of the gentian violet solution. A cure usually results in three weeks. Epilation with X rays clears up the condition and when there is considerable thickening of the corium, recourse to this method of treatment may be necessary.

Dyskeratosis Congenita.

H. N. COLE, J. E. RAUSCHKOLB AND J. TOOMEY (*Archives of Dermatology and Syphilology*, January, 1930) report a case of unusual dyskeratosis of the skin and refer also to two similar cases from another clinic. A review is also given of similar examples of dyskeratosis mentioned in the literature. The patient described had a scarf-like pigmented eruption of the neck, an acrocyanosis of the hands and feet with hyperhidrosis of the palms and soles, a dystrophy of the nails and a leucoplakia-like eruption of the tongue and hard palate. The more advanced changes seen in the microscopical sections included a thin epidermis with little or no papillary arrangement; some papillæ were more prominent with an extensive œdema extending down into the corium. Vessels were swollen and numerous, with mononuclear cellular infiltration. A few plasma cells and fibroblasts were noted. Pigment cells were seen in large clumps around the vessels and hair papillæ. Some hyaline change was observed in the collagen fibres of the upper corium. In a summary the observers state that the condition is probably congenital and familial and is accompanied by symptoms of atrophy, pigmentation, dystrophic changes in the nail and by leucokeratosis of the mucous membrane of the mouth. The process has some characteristics in common with the dystrophic type of *epidermolysis bullosa*, with Darier's disease and with the juvenile type of *acanthosis nigricans*. It probably approaches closest, however, to the syndrome described by Jadassohn and Lewandowsky under the term *pachyonychia congenita*. The writers believe the characteristics of the latter syndrome to have been well enough defined in eighteen cases in the literature to entitle it to the designation of a distinct disease.

Erythema Exudativum Multiforme (Hebra).

E. RAMEL (*The British Journal of Dermatology and Syphilis*, January, 1930) in discussing the ætiology of *erythema multiforme*, states that the theory of the streptococcal origin of this condition had been held by him until in an endeavour to assess its positive value he was struck by the inconclusive nature of the facts and arguments on which it is based. Hæmo-culture yielded no positive results. The author agrees that there is a close relationship between *erythema multiforme* and *lupus erythematosus*. In a previous paper he stated that in eight cases investigated Koch's bacillus was demonstrated both in the blood and in the lesions. In describing his investigations in four new cases his results were entirely concordant with his previous findings that *erythema multiforme* is due to a hæmatogenous tuberculous infection. The type of tuberculosis was peculiar in that it was demonstrated only by inoculation of guinea-pigs in which it produced an attenuated lesion. After successive inoculations through a series of animals, virulence increased until numerous acid-fast bacilli were eventually recoverable with ease. One patient gave a strongly positive von Pirquet reaction after forty-eight hours.

Conjunctivitis as a Trichophytide Manifestation.

I. MVENDE (*The British Journal of Dermatology and Syphilis*, January, 1930) reports a patient with a deep-seated trichophyton infection of the scalp with lesions on the neck and body. The patient was a ten year old boy. At the outset the trichophytin reaction almost failed to appear, but when later the allergic state or degree of sensitization increased, the trichophytin reaction was well marked. Sixteen days after an exposure to an epilating dose of X rays the patient developed a generalized trichophytide which resembled chicken pox, also a conjunctivitis which simulated Calmette's reaction as seen in scrofulous individuals. This was accompanied by malaise and a rise in temperature. The eruption and conjunctivitis gradually subsided in fifteen days. The trichophytin test, carried out two days after the appearance of the trichophytide, yielded a strongly positive reaction and there was a focal reaction. The lesions on the body assumed the characteristics of *lichen trichophyticus* and there developed another area of infiltration with pus formation on the scalp. This showed that the same antigen can give rise to a very varied picture, depending on the degree of allergy and the site of reaction between the antigen and antibody. The pronounced trichophytin reaction was an indication of the high degree of sensitization, while the allergic nature of the clinical condition was further supported by the focal reaction to trichophytin. The author draws attention particularly to the fact that the allergic phenomenon—conjunctivitis—developed in association with a generalized trichophytide in a patient with a deep-seated, inflammatory trichophyton infection just as it does in a tuberculous condition.

British Medical Association News.

MEETING OF THE FEDERAL COMMITTEE.

A MEETING OF THE FEDERAL COMMITTEE OF THE BRITISH MEDICAL ASSOCIATION IN AUSTRALIA was held on March 28, 1930, at the Medical Society Hall, East Melbourne, SIR HENRY NEWLAND, C.B.E., D.S.O., in the chair.

Representatives.

The following representatives of the Branches were present:

New South Wales Branch: Dr. J. A. Dick, C.M.G., Dr. R. H. Todd.

Queensland Branch: Dr. D. G. Croll, C.B.E., Dr. E. S. Meyers.

South Australian Branch: Sir Henry Newland, C.B.E., D.S.O.

Tasmanian Branch: Dr. A. W. Shugg, Dr. Gregory Sprott.

Victorian Branch: Dr. F. L. Davies, Dr. J. Newman Morris.

Sir Henry Newland and Dr. R. H. Todd acted as proxies for Dr. F. A. Hadley and Dr. D. D. Paton, of the Western Australian Branch, respectively. Sir Henry Newland acted as proxy also for Dr. B. Smeaton, of the South Australian Branch.

Henry William Armit.

Reference was made by the Chairman to the death of Dr. Henry William Armit, Editor of THE MEDICAL JOURNAL OF AUSTRALIA, which had taken place at his home at Woolwich, Sydney, on March 12, 1930, and to the fact that at the funeral the Federal Committee had been represented by Dr. J. Adam Dick and Dr. R. H. Todd. On the motion of Dr. R. H. Todd, seconded by Dr. J. A. Dick, it was resolved:

> That the Federal Committee records with sorrow the death of Dr. Henry William Armit, M.R.C.S., Eng., L.R.C.P., Lond., the Editor of THE MEDICAL JOURNAL OF AUSTRALIA, which took place after a short illness on March 12, 1930, within three months of completing sixteen years as Editor of the Journal. The Committee desires to place on record its profound appreciation of the great services rendered to the Association and the profession in Australia by his acceptance of office as Editor of THE MEDICAL JOURNAL OF AUSTRALIA in June, 1914, and for doing so with untiring zeal for the advancement of medical science and the honour and interests of the medical profession.

A copy of the resolution was directed to be sent to Mrs. Armit.

Minutes.

The minutes of the previous meeting of September 2, 1929, copies of which had been sent to the members after the meeting, were submitted and signed as correct.

Financial Statement.

The financial statement for the six months ended December 31, 1929, prepared by Messrs. Coates, Cunningham and Company, Public Accountants, and audited by the Honorary Auditor, Dr. W. H. Crago, was presented and adopted. The statement showed a balance to the credit of the general (Federal Committee) account of £645 19s. 8d. and of the Australasian Medical Congress (British Medical Association) accumulated funds account, £469 16s. 3d.

Officers.

Officers for the year were appointed as follows: *Chairman*, Sir Henry Newland, C.B.E., D.S.O.; *Vice-Chairman*, Dr. J. Newman Morris; *Honorary Secretary and Honorary Treasurer*, Dr. R. H. Todd; *Honorary Auditor*, Dr. W. H. Crago.

Return of Representatives.

The return of representatives of the several Branches elected for the year 1930 was presented as follows:

New South Wales Branch: Dr. J. Adam Dick, C.M.G., Dr. R. H. Todd.

Queensland Branch: Dr. D. G. Croll, C.B.E., Dr. E. S. Meyers.

South Australian Branch: Sir Henry Newland, K.B.E., Dr. B. Smeaton.

Tasmanian Branch: Dr. A. W. Shugg, Dr. Gregory Sprott.

Victorian Branch: Dr. F. L. Davies, Dr. J. Newman Morris.

Western Australian Branch: Dr. F. A. Hadley, Dr. D. D. Paton.

Preliminary Business.

A letter was received from the Secretary of the Victorian Branch conveying an invitation to the members of the Federal Committee to dine with the Council of the Branch at the Windsor Hotel on March 28.

British Medical Association Annual Meeting (1930), Winnipeg.

At the previous meeting, in accordance with a request of the Council of the Association to nominate a member for the purpose, Dr. J. S. Purdy had been nominated to attend the annual (1930) meeting of the British Medical Association, to be held in Winnipeg, as a representative of the Branches in Australia in the Section of Medical Sociology and History, the subject for a special meeting of the section being "The Problems of Migration Within the Empire." Dr. Purdy subsequently found that his official duties would prevent his absence at the time of the meeting. Sir James Barrett kindly accepted nomination in his place and the Council, it was understood, had appointed him.

British Medical Association Scholarships and Grants.

The Honorary Secretary advised that, in accordance with the practice introduced some years ago, he had distributed the information received from the Deputy Medical Secretary on behalf of the Science Committee of the Council in regard to the British Medical Association Scholarships and Grants for the year 1930; and that he had been instrumental in forwarding to the Committee an application received from one member for a research scholarship, together with the necessary confidential certificates which he had obtained in the way required by the regulations.

Model Rules for Ethical Procedure.

The Honorary Secretary also informed the Committee, in regard to the Model Rules governing Procedure in Ethical Matters for Branches in Australia, which had been approved by the several Branches after further revision undertaken on the suggestion of the Central Ethical Committee, that they had been forwarded to the Central Ethical Committee where, the Deputy Medical Secretary advised, they were receiving attention. As there appeared to be some delay, he was requested to write and ask for any information that might be available.

Federal Council.

The proposal for the formation of a Federal Council for the Branches in Australia which had been before the several Branches since the last meeting of the Committee in September, 1929, was submitted for further consideration in the light of recommendations and requests for alterations received from the Victorian and New South Wales Branches. The draft Memorandum and Articles of Association and By-Laws, as printed in THE MEDICAL JOURNAL OF AUSTRALIA of January 18, 1930, at page 92, were taken *seriatim* and discussed. Clause 3 of the Memorandum was verbally altered by the omission of the word "on," "determined" being preferred to "determined on," in the phrase "in such manner as may from time to time be determined on." In the Articles of Association, Article 10, "December" was substituted for "October" in line 10, and "January"

for "November" in line 7. This had reference to the time for the election of members of the Council representing the several Branches to be held, the substituted months being more convenient to some Branches as being the months in which the annual election of the Branch Council took place under the Branch rules. Article 14, fixing the membership of the Executive Committee, was the subject of discussion. The proposed Article read:

> The number of members of the Executive Committee inclusive of *ex officio* members shall not be less than three nor more than six.

The New South Wales Branch made two proposals, namely: (i) That the number of members inclusive of the *ex officio* members (President and Secretary) be "six"; and (ii) that no more than one member representing any one Branch be a member of the Executive Committee. As against the fixed larger number, six, stress was laid on the importance of having the Committee as small as possible so as to allow of its being convened easily and at short notice and of its travelling about from place to place to deal with particular matters as they arose. On the other hand, in view of the fact that the Executive Committee was to be a complete substitute for the whole Federal Council and to have the same powers and the same range of duties as the Federal Council as a whole, also that it could only act on behalf of the Branches collectively in the same way as the Federal Council itself could act, it was urged that it was not right that it should be constituted by representatives of some Branches only to the exclusion of others. The proposal for the number of members to be fixed at six, including *ex officio* members, one representing each Branch, was carried. After the luncheon adjournment, however, permission was given for the matter to be reopened. It was put to the vote again and the previous decision in favour of amending the article was reversed; so that the draft article remained unaltered, reading:

> The number of members of the Executive Committee inclusive of *ex officio* members shall not be less than three nor more than six.

Article 19 was deleted as being superfluous.

In Article 25 (*c*) the word "collectively" was inserted after the word "Branches" as a verbal alteration only; and Article 29 (*d*) was deleted as superfluous. In Article 27 (i), line 8, the words "in Australia" were inserted after the words "British Medical Association"; and in Article 27 (iv), as well as in Article 27 (v), the words "other than the Executive Committee" were inserted after the word "Committee" as occurring in each.

In Article 28 (i) the word "may" was substituted for the word "shall"; and in Article 31, line 2, "four" was substituted for "three" where it occurred both at the beginning and the end of the line, so as to make it read: "Four or more members representing not less than four Branches."

In Article 38, line 4, the words "of another Branch or" were inserted after the words "such Branch or," so that the line reads "member of such Branch or of another Branch or of the Federal Council."

In Article 41, in line 1, the name "Robert Henry Todd" was inserted so as to make it read:

> Robert Henry Todd shall be the first Secretary.

In By-Law 3 the words "where the President shall not be a member of the Committee such Committee shall have power to appoint its own Chairman" were deleted. In By-Law 4, line 4, the word "four" was inserted before the word "members." In By-Law 6 the words "in Australia" were inserted after the words "British Medical Association." In By-Law 15 (iii) the word "two" was substituted for the word "ten" in the last line, so as to make it read:

> (iii) To meet the general and other expenses of the Federal Council, the Treasurer of each Branch shall pay to the Federal Council such sum or sums as the Federal Council may require, provided that the total so payable in any year shall not exceed a sum equal to two shillings per member of the Branch.

It was finally arranged that copies of the Constitution as amended should be sent to the several Branches in Australia for the formal approval of each; and that, on receipt of the formal approval of all of them, it should be submitted to the Council of the British Medical Association in accordance with the requirements of the British Medical Association By-Laws, By-Law 23 (2) which reads:

> Any proposal for the formation of any such Federal Council, specifying the area in which the same is intended to act and its constitution, powers and duties, shall be submitted by the Branches concerned to the Council, and no such proposal shall become operative unless and until the same shall have been approved by the Council.

Conference of Oversea Representatives.

At the instance of the New South Wales Branch, a proposal of Dr. E. R. Fothergill, of Hove, Sussex, a member of the Council who takes a close interest in the Association oversea, was submitted for a conference of representatives of Federal Councils and oversea Branches and Divisions in England every five or seven years, commencing in 1932. Dr. Fothergill's proposal had been submitted for consideration by all the Branches. After discussion, a motion was moved by Dr. J. Newman Morris:

> That the Federal Committee recommend the Central Council to make an effort to get together the representatives of the Dominions and overseas Branches on the day before the Annual Representative Meeting and bring before such representatives the overseas business of the Representative Meeting; that the Overseas Committee be appointed to prepare the agenda paper; and that the Chairman of the Representative Body be asked to take the chair at the meeting of the Overseas Body.

The motion was withdrawn and it was resolved, on the motion of Dr. R. H. Todd, seconded by Dr. J. A. Dick:

> That the Medical Secretary, Dr. Alfred Cox, be communicated with and asked for advice on the proposal of Dr. Fothergill.

Annual Subscription to the British Medical Association.

A proposal that the financial arrangements of the Branches in Australia with the British Medical Association be revised was received from the Victorian Branch. The Victorian Branch letter on the subject, a copy of which had been forwarded to all the other Branches as well as to the members of the Committee, was read. Dr. F. L. Davies drew attention to the paragraph in the "Annual Hand-book," 1929-1930, at page 71, under the heading "Apportionment of Member's Subscription," in which a table was given indicating how the subscription of a member was apportionable towards defraying the expenses of the Association for the year 1928. The table was read as follows:

	£	s.	d.	£	s.	d.
Central Meeting Expenses ..	8,605	0	0	0	5	0
General Association Expenses ..	8,862	0	0	0	4	0
Central Staff Expenses	18,565	0	0	0	10	9
Central Printing, Stationery and Postage Expenses	2,938	0	0	0	1	8
Library Account Expenses ..	996	0	0	0	0	7
Journal Account Expenses ..	12,047	0	0	0	7	0
Irish Committee Expenses ..	1,081	0	0	0	0	8
Scottish Committee Expenses ..	2,138	0	0	0	1	3
Capitation Grants to Branches	6,856	0	0	0	4	0
Subscriptions written off	3,770	0	0	0	2	2
Depreciation	4,420	0	0	0	2	6
Sundry Publications	144	0	0	0	0	1
Part Transfer to Sinking Fund, Reserves *et cetera*	4,270	0	0	0	2	5
	£82,809	0	0	£2	7	11

It was resolved, on the motion of Dr. F. L. Davies, seconded by Dr. J. Newman Morris:

> That the Federal Committee approach the Central Council with a view to the reduction of subscription payable on behalf of members in Australia from £1 5s. 6d. (£1 11s. 6d. less 6s. capitation allowance) to £1 1s.

Australasian Medical Congress (British Medical Association).

Third Session.

It was noted that the sum of £100, advanced to the Executive Committee of the Third Session of Congress (Sydney, 1929) by the Federal Committee from the Australasian Medical Congress Accumulated Funds Account, had been repaid. Suggestions were received from the Executive Committee of the Third Session which were made by the Section of Pathology and Bacteriology, that (*a*) the name of the Section be altered to "Section of Pathology, Bacteriology and Experimental Medicine" and (*b*) science graduates engaged in medical activities in approved laboratories be invited to take part in meetings of the Section at future congresses. As both of the suggestions were matters that came within the scope of the Executive Committee of Congress and not of the Federal Committee, it was directed that they be sent on to the Executive Committee of the next, the fourth, session of Congress.

Fourth Session.

In regard to the time and place at which the fourth session of Congress was to be held, which had been discussed at the previous meeting of the Committee in September, 1929, invitations were received both from the South Australian and the Western Australian Branches, the former for it to be in Adelaide in May, 1932, and the latter in October, 1932. Sir Henry Newland, on behalf of the South Australian Branch, informed the Committee that the South Australian Branch was pleased to waive any claim it might have in favour of the Western Australian Branch. He explained that Dr. F. A. Hadley, speaking on behalf of himself and his colleagues in the Western Australian Branch, had expressed the hope that the Committee would see its way to accept the invitation of the Western Australian Branch and had pointed out that October was not only the most suitable time of the year, but also would allow of those members of the Branches in Australia who had been in England for the annual meeting of the Association in July, 1932, when the Centenary of the British Medical Association was to be celebrated, attending the Australasian Medical Congress in Perth on their way back. Dr. A. W. Shugg stated that the Tasmanian Branch had hoped that the fourth session might be in Hobart. An invitation, however, had not been sent, because, although Congress had met in the year 1902, it was feared that difficulty might arise owing to the accommodation at the University being insufficient for the present requirements. The question was raised whether the great distance to be travelled from other States would not be an obstacle to a large attendance if the session were in Perth, and whether, on that account, Adelaide should not be preferred. It was decided, however, with very little discussion, that the invitation of the Western Australian Branch to hold the fourth session of Congress in Perth in October, 1932, be accepted.

Regulations of Congress.

A proposal was submitted for the amendment of the regulations governing "Sectional Meetings" for the limitation of the number of words in a paper so that its reading should not exceed twenty minutes. It was resolved, on the motion of Dr. R. H. Todd, seconded by Dr. J. A. Dick:

> That Regulation 13 (i) (1) be amended by the addition of the words "no such paper shall contain more than 3,000 words."

Repatriation Department.

A letter was received from the Victorian Branch suggesting that matters in connexion with the Repatriation Department be referred to a subcommittee to be dealt with and, after the position in regard to a particular matter in which finality had not been reached, was explained, it was resolved, on the motion of Dr. Gregory Sprott, seconded by Dr. J. A. Dick:

> That Dr. J. Newman Morris and Dr. F. L. Davies be a subcommittee of the Federal Committee to approach the Repatriation Department in regard to the question of payment of mileage to Dr. — in connexion with his attendance on Mrs. R.G., a beneficiary of the Repatriation Department, whose husband's death was due to war services.

Australian Soldiers Repatriation Act, 1920-29.

A proposal was submitted at the instance of the Victorian Branch that the Department be asked to inform medical attendants of ex-soldiers that clinical notes are, under the provisions of the Act as amended in 1929, now available for perusal by the ex-soldier when his case is under consideration. The effect of the new legislation, which constitutes two new appeal tribunals, dealt with the matter of information given to the Commission upon a confidential basis. Although medical reports are not specifically mentioned, they had always been given on the understanding that they were confidential, and as a matter of fact were, so it is understood, always officially marked "confidential." Under the new departmental practice, however, it was ascertained that medical reports are no longer marked "confidential." It was felt, therefore, that the medical attendants of ex-soldiers should be made aware of the alteration in practice and it was resolved, on the motion of Dr. F. L. Davies, seconded by Dr. J. Newman Morris:

> That the Repatriation Department be asked to inform medical practitioners that, when clinical notes are asked for, all such information is available for perusal by the ex-soldier whose case is being considered.

Medical Services to Natives in Central Australia.

At the previous meeting of the Committee attention had been drawn to the problem of disease in aborigines in Central Australia, in places remote from white population, when a proposal was put forward for the training of natives or half-castes as orderlies for employment under the control of qualified medical practitioners. The Department of Home Affairs had been communicated with and had supplied information of what had been done and what it was proposed to do, showing that the problem was having the Department's serious attention. It was moved by Dr. F. L. Davies, seconded by Dr. J. Newman Morris:

> That the Minister for Home Affairs be asked to grant an interview in regard to the matter of medical services to natives in Central Australia.

Dr. D. G. Croll referred to the report (1928) made by the Chief Protector of Aboriginals (Queensland) on "The Aboriginals and Half Castes of Central Australia and North Australia," in which the questions under discussion were authoritatively dealt with. Dr. Croll suggested that care should be taken by the Committee in approaching the Minister in a matter which was apparently receiving full attention. He thought that the Committee might express its approval of the principle that the Protector of Aboriginals should be a medical man. The motion before the meeting was withdrawn and it was resolved, on the motion of Dr. J. Newman Morris, seconded by Dr. D. G. Croll:

> (1) That the Federal Committee views with grave concern the reports as to the need for medical attention amongst the aboriginal populations of Australia and its Mandated Territories;
>
> (2) That a subcommittee be appointed to inquire into the matter;
>
> (3) That the Branch Councils be requested to appoint, from amongst the Branch members, committees of inquiry, and that these State committees be asked to forward the result of their deliberations to the subcommittee of the Federal Committee.

It was resolved, on the motion of Dr. D. G. Croll, seconded by Dr. E. S. Meyers:

> That Dr. F. L. Davies and Dr. J. Newman Morris be appointed a subcommittee with power to coopt, to report to the Federal Committee.

Naval Medical Service.

The conditions of service of Naval Medical Officers had been the subject of discussion at the previous meeting of the Committee. The Navy Office had again been communicated with and a reply received, from which it appeared to the Committee that the present was not a suitable time for it to interfere. It was resolved, on the motion of Dr. D. G. Croll, seconded by Dr. Gregory Sprott:

> That the Minister be thanked for his reply and advised that the position is appreciated by the Committee.

Commonwealth Serum Laboratories: Cost of Products.

It was resolved, on the motion of Dr. D. G. Croll, seconded by Dr. E. S. Meyers:

> That a letter be written to the Minister for Health of the Commonwealth pointing out the discrepancies in cost of serums to the public and to hospitals and asking that an adjustment should be made.

Post-Graduate Work.

A letter was received from the Queensland Branch forwarding a copy of a letter addressed by it to Sir Ewen Maclean in reference to "post-graduate facilities in the British Isles," and requesting that the Federal Committee would take any action it might consider advisable for the furtherance of the object in view. Reference was made to the work of the Association in this connexion and it was noted that the help and advice given as to facilities for post-graduate education in London and the British Isles and on the Continent was increasing. It was resolved, on the motion of Dr. J. Newman Morris, seconded by Dr. A. W. Shugg:

> That a letter be written to the Central Council asking that further facilities be made for post-graduate work for visitors from the Dominions.

A communication was also received from the Queensland Branch forwarding a resolution of the Branch asking the Federal Committee to give consideration to the question of arranging post-graduate lectures by oversea lecturers in as many States as possible. On the motion of Dr. J. Newman Morris, seconded by Dr. F. L. Davies, it was resolved:

> That no action be taken.

On the motion of Dr. E. S. Meyers, seconded by Dr. D. G. Croll, it was resolved:

> That the Federal Committee request the post-graduate work committees of the several States to give each other all the information in their possession in regard to the movements of visiting lecturers.

Remuneration of Ships' Surgeons.

The question of negotiating with shipping companies trading between Australia and oversea ports, with a view to the better remuneration of ships' surgeons, which had been discussed at the meeting held in April, 1929, was mentioned by the Honorary Secretary. He informed the Committee of what he had been able to do and of the difficulties encountered owing to there being no association of companies concerned as there was of the companies under the Australian Commonwealth *Navigation Act*.

Registration in England of Medical Practitioners Qualified in an Australian State.

The Western Australian Branch had drawn attention to the fact that a practitioner registered in Western Australia as holding the degrees of the Melbourne University could not be registered in England unless he were registered in Victoria, the State where his qualifications had been obtained. It was pointed out that Victorian graduates could not register in Victoria except on personal attendance before the Medical Board (*vide Medical Act*, Victoria, S. 13), and that the General Medical Council (*vide Medical Act*, United Kingdom, 1886, S. 11) is not allowed by law to recognize colonial medical diplomas unless it is satisfied that the holder is by law entitled to practise medicine, surgery and midwifery in the British possession where the diploma was issued. It was resolved, on the motion of Dr. R. H. Todd, seconded by Dr. F. L. Davies:

> That the General Medical Council be communicated with with a view to graduates of Australian universities being registered in England if they are registered in any State in Australia.

Contract Attendance, Friendly Society Lodges.

The Queensland Branch had forwarded some resolutions passed at a meeting of practitioners interested in friendly society lodge practice, held in Sydney, September 2, 1929, and requested that consideration be given to them by the Federal Committee. It was resolved, on the motion of Dr. E. S. Meyers, seconded by Dr. D. G. Croll:

> That the resolutions of the meeting of September 2, 1929, be referred to the Federal Council, if any, when formed, namely:
>
> 1. There is a necessity for a central Federal body to coordinate the views of contract practitioners in all the States.
> 2. A Federal Council, if formed, would require a subcommittee representing contract practitioners, not necessarily of its own members.
> 3. It is suggested that there should be two representatives from each State with the right to appoint standing proxies, not necessarily members of the Committee.
>
> It is suggested that the Committee be elected by the Councils of the Branches.

Date and Place of Next Meeting.

It was determined that it be left to the Chairman to fix the date and place of the next meeting.

Thanks.

Votes of thanks were accorded to the Chairman, Sir Henry Newland, for presiding at the meeting, and to the Victorian Branch Council for the accommodation provided for the meeting and for their hospitality to the visiting members of the Committee.

NOMINATIONS AND ELECTIONS.

The undermentioned have been nominated for election as members of the New South Wales Branch of the British Medical Association:

Finn, Clement Hubert, M.B., Ch.M., 1926 (Univ. Sydney), Canowindra, New South Wales.

Gillies, Gladstone Russell, M.B., Ch.M., 1924 (Univ. Sydney), 3, Bondi Road, Waverley.

Correspondence.

DIATHERMY OF TONSILS.

SIR: Dr. Pern's communication is so extraordinary that I hesitate to comment on it. I tried the unipolar method for several months, but gave it up, as it was too slow. An "Oudin" unit is a standard and all reputable machines give the same output. The amount of coagulation necrosis produced by plunging a needle into a tonsil is so infinitesimal that it is useless. The inefficiency of the treatment detailed by Dr. Pern has been a great stumbling block to the adoption by specialists of treatment by diathermy.

Dr. Francis has a tilt at removal by diathermy. First as regards complete removal, as I have pointed out, complete removal is quite easy to perform, but in adults is not always necessary. Tonsillotomy, to which he refers, was dangerous because the remaining crypts were more easily affected. I am not dogmatic about leaving some tonsillar tissue in adults as my experience only dates back two and a half years. So far I have not had a case with recurrence of symptoms. Surely Dr. Francis is a little optimistic about discomfort up to four days after tonsil-

lectomy. Perhaps he meant up to fourteen days. Last week I had my first case of hæmorrhage after diathermy which was easily stopped by a local practitioner. If you give a patient the choice between several treatments over a prolonged period which would take up seven to eight hours of his time, or a quick removal which would take up at least twenty-four times as much of his time, I wonder which he would choose, especially if you could convey to him the agony that he would undergo for at least four days.

Yours, etc.,

W. KENT HUGHES.

22, Collins Street,
Melbourne.
May 1, 1930.

Books Received.

PRACTICAL PSYCHOLOGY AND PSYCHIATRY, FOR USE IN TRAINING-SCHOOLS FOR ATTENDANTS AND NURSES AND IN MEDICAL CLASSES, AND AS A READY REFERENCE FOR THE PRACTITIONER, by C. B. Burr, M.D.; Sixth Edition; 1930. Philadelphia: F. A. Davis Company. Demy 8vo., pp. 378, revised and enlarged with illustrations. Price: $2.75 net.

TONSIL SURGERY, BASED ON A STUDY OF THE ANATOMY, by Robert H. Fowler, M.D.; 1930. Philadelphia: F. A. Davis Company. Demy 4to, pp. 288, with 103 illustrations, including ten full-page colour plates. Price: $10.00 net.

THE PRACTICAL MEDICINE SERIES, COMPRISING EIGHT VOLUMES ON THE YEAR'S PROGRESS IN MEDICINE AND SURGERY: General Surgery, edited by Evarts A. Graham, A.B., M.D.; 1929. Chicago: The Year Book Publishers. Crown 8vo., pp. 800, with illustrations. Price: $3.00 net.

Diary for the Month.

MAY 12.—Queensland Branch, B.M.A.: Medical Section.
MAY 13.—New South Wales Branch, B.M.A.: Ethics Committee.
MAY 20.—New South Wales Branch, B.M.A.: Executive and Finance Committee.
MAY 23.—Queensland Branch, B.M.A.: Council.
MAY 27.—New South Wales Branch, B.M.A.: Medical Politics Committee.
MAY 28.—Victorian Branch, B.M.A.: Council.
MAY 29.—New South Wales Branch, B.M.A.: Branch.
MAY 29.—South Australian Branch, B.M.A.: Branch.
JUNE 3.—New South Wales Branch, B.M.A.: Organization and Science Committee.

Medical Appointments.

Dr. K. B. Shallard (B.M.A.) has been appointed Government Medical Officer at Tea Gardens, New South Wales.

* * *

Dr. I. B. Jose (B.M.A.) has been appointed Honorary Surgeon in the Adelaide Hospital, Adelaide, South Australia.

* * *

Dr. A. T. Britten Jones (B.M.A.) has been appointed Honorary Assistant Surgeon in the Adelaide Hospital, Adelaide, South Australia.

* * *

Dr. H. Masel (B.M.A.) has been appointed Government Medical Officer at Stanthorpe, Queensland.

* * *

Dr. R. B. Austin (B.M.A.) has been appointed Government Medical Officer at Armidale, New South Wales.

Medical Appointments Vacant, etc.

FOR announcements of medical appointments vacant, assistants, *locum tenentes* sought, etc., see "Advertiser," page xvi.

BRISBANE AND SOUTH COAST HOSPITALS BOARD: Medical Vacancies.

ROYAL HOSPITAL FOR WOMEN, PADDINGTON: Resident Medical Officer.

Medical Appointments: Important Notice.

MEDICAL practitioners are requested not to apply for any appointment referred to in the following table, without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

BRANCH.	APPOINTMENTS.
NEW SOUTH WALES: Honorary Secretary, 21, Elizabeth Street, Sydney.	Australian Natives' Association. Ashfield and District United Friendly Societies' Dispensary. Balmain United Friendly Societies' Dispensary. Friendly Society Lodges at Casino. Leichhardt and Petersham United Friendly Societies' Dispensary. Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney. North Sydney Friendly Societies' Dispensary Limited. People's Prudential Assurance Company, Limited. Phœnix Mutual Provident Society.
VICTORIAN: Honorary Secretary, Medical Society Hall, East Melbourne.	All Institutes or Medical Dispensaries. Australian Prudential Association Proprietary, Limited. Mutual National Provident Club. National Provident Association. Hospital or other appointments outside Victoria.
QUEENSLAND: Honorary Secretary, B.M.A. Building, Adelaide Street, Brisbane.	Members accepting apopintments as medical officers of country hospitals in Queensland are advised to submit a copy of their agreement to the Council before signing. Brisbane United Friendly Society Institute. Mount Isa Hospital.
SOUTH AUSTRALIAN: Secretary, 207, North Terrace, Adelaide.	All Lodge Appointments in South Australia. All Contract Practice Appointments in South Australia.
WESTERN AUSTRALIAN: Honorary Secretary, 65, Saint George's Terrace, Perth.	All Contract Practice Appointments in Western Australia.
NEW ZEALAND (Wellington Division): Honorary Secretary, Wellington.	Friendly Society Lodges, Wellington, New Zealand.

Medical practitioners are requested not to apply for appointments to positions at the Hobart General Hospital, Tasmania, without first having communicated with the Editor of THE MEDICAL JOURNAL OF AUSTRALIA, The Printing House, Seamer Street, Glebe, New South Wales.

Editorial Notices.

MANUSCRIPTS forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary be stated.

All communications should be addressed to "The Editor," THE MEDICAL JOURNAL OF AUSTRALIA, The Printing House, Seamer Street, Glebe, New South Wales. (Telephones: MW 2651-2.)

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